

THE JOURNAL OF MENTAL SCIENCE

[Published by Authority of the Royal Medico-Psychological
Association.]

No. 409 [NEW SERIES
No. 373.]

OCTOBER, 1951.

VOL. XCVII

Part I.—Original Articles

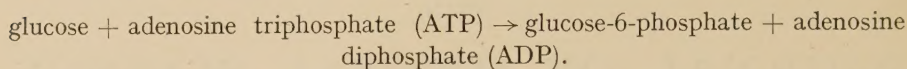
ACTIVATORS AND INHIBITORS OF HEXOKINASE IN HUMAN BLOOD.

By H. WEIL-MALHERBE, M.D., D.Sc., and A. D. BONE,
Runwell Hospital, Wickford, Essex.

THE endocrine system is one of the foremost links in the psychosomatic relationship, and its special significance in the study of mental disease needs no emphasis. Compared with our knowledge of the chemistry and basic functions of the hormones very little is known about their more intimate mechanisms of action. It has been possible to assign to some hormones the function of controlling the rate of specific metabolic processes, but whether they do so by a direct reaction with a component of one or more enzyme systems or indirectly by influencing the mutual accessibility of enzyme and substrate is still a matter of discussion. The latter mechanism would depend on a spatial organization involving membrane barriers, phase boundaries or similar discontinuities and, in fact, many hormonal effects which can be demonstrated *in vitro* with the aid of intact or sliced tissues disappear when the structural organization of the cell is destroyed. It is, however, well to remember that synthetic and other energy-consuming reactions were believed until recently to depend on the integrity of the cellular organization, but when some insight was gained into the mechanism of biological energy transformation and the function of labile phosphate bonds in these processes, it was possible to demonstrate many such reactions in homogeneous systems. Similarly, the interactions of hormones and enzymes may require the intervention of unstable mediators, and control of these factors might allow their reconstruction in cell-free extracts. In any case, it is more satisfying to account for the great specificity of hormonal action on the basis of a chemical reaction with specific enzymes than by a mechanism leading to predominantly physical changes.

A hormonal system, many actions of which can be explained by its control of a single metabolic process, is that of insulin and its antagonists. The reaction in question is the phosphorylation of glucose (cf. Bouckaert and De

Duve, 1947), which is catalysed by the enzyme hexokinase and may be represented by the equation :



Hexokinase is readily extractable, and the possible regulation of its activity by hormones can be investigated in homogeneous solution. The experiments of Colowick, Cori and Slein (1947) provided some evidence of such a mechanism. These authors described an inhibition of the hexokinase activity of brain and muscle extracts by an unstable protein fraction of the anterior pituitary gland. The inhibition was enhanced by adrenocortical extract, which by itself had no effect on the muscle hexokinase of normal rats, although it inhibited the muscle hexokinase of alloxanized rats. Addition of insulin reversed these inhibitions, whereas insulin alone did not affect the activity of the uninhibited hexokinase. These observations account for some hormonal actions on intact tissues, but not for others: since insulin increases the glucose uptake of the excised diaphragm of hypophysectomized or of hypophysectomized-adrenalectomized rats, which were presumably deprived of hormonal inhibitors (Krahl and Park, 1948; Perlmutter and Greep, 1948; Bornstein and Nelson, 1948; Villee and Hastings, 1949), an activation of uninhibited hexokinase by insulin might have been expected.

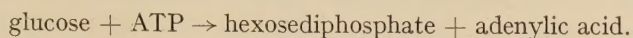
When the experiments of Colowick *et al.* were repeated by other investigators these effects were found to be inconstant and exceptional (Broh-Kahn and Mirsky, 1947; Reid, Smith and Young, 1949; Smith, 1949). Stadie and Haugaard (1949), working with muscle extracts of alloxanized rats, and Stadie, Haugaard and Hills (1950), using muscle extracts of depancreatized cats, failed to find a decrease of hexokinase activity in these preparations, or any effect on it of adrenocortical extract or of insulin, either singly or together. Christensen, Plimpton and Ball (1949) studied the hexokinase activity of cytolysed rat blood corpuscles, and obtained similar results with blood from normal, diabetic and hypophysectomized animals in presence as well as in absence of insulin or adrenocortical extract. Cori himself (1950) recently referred to the fact that the experiments with hexokinase in solution did not have the desired degree of reproducibility. Nevertheless, it need not necessarily be concluded that the observations of Colowick *et al.* are erroneous, but rather, that our control of the factors involved is, as yet, incomplete.

The results of Colowick *et al.* suggested the possibility of using the hexokinase reaction as a test system for the assay of hormonal changes in human blood. It soon became apparent that both plasma and corpuscles contained components which strongly affected the hexokinase activity of rat-brain extracts. These effects were studied under a variety of conditions and in a variety of cases.

As a preliminary the properties of the test system were studied in detail (Weil-Malherbe and Bone, 1951*a*). For the purpose of the investigation it seemed inadvisable to use purified hexokinase preparations, in order to avoid the loss of other tissue constituents which might conceivably be involved in the interaction with hormones. It was found that rat brain extracts had a higher and more stable hexokinase activity than rat muscle extracts, and that they

were less subject to undesirable side reactions. The standard test system therefore contained an aqueous extract of rat brain, but the effects on brain hexokinase were frequently compared with those on muscle hexokinase.

When glucose and ATP were added to rat brain extract, the principal reaction was found to be the following :



The extract therefore contained, in addition to hexokinase, the enzymes phosphohexokinase (conversion of hexosemono- to hexosediphosphate) and myokinase (utilization of the intermediary phosphate group of ATP). Other enzymic side reactions only occurred at a negligible rate. The glycolytic breakdown of glucose stopped at the triosephosphate stage owing to the rapid enzymic destruction of codehydrogenase 1 in brain extracts.

Particular attention was paid to the study of possible activators or inhibitors of hexokinase. As potential activators, substances were tested which were known to have an unspecific protective action on enzymes by virtue of their colloidal nature, their affinity for heavy metals or their capacity for preventing the oxidation of thiol groups. No significant activation of hexokinase was observed by any of these substances, added alone or in combination. Other substances, including insulin, tested because of a possible specific function in connection with the hexokinase reaction, were likewise without effect. The enzyme activity did not appreciably deteriorate during the experiments; on the whole, therefore, rat brain hexokinase appeared to be a stable and robust system, not unduly influenced by chance variations of the environment.

The product of the reaction, glucose-6-phosphate, was found to be a specific inhibitor of brain hexokinase. The inhibition was non-competitive with respect to both glucose and ATP. Owing to the presence of phosphohexokinase, however, inhibitory concentrations of glucose-6-phosphate did not accumulate during the phosphorylation of glucose by rat brain extracts.

EXPERIMENTAL.

The present communication primarily deals with the effects of human plasma on the hexokinase activity of rat brain extracts. The investigation of the plasma effects was often supplemented by that of the effects of the corresponding erythrocyte lysates ("haemolysates," for short). In other experiments the effects of plasma or haemolysates on rat brain extract were compared with those on rat muscle extract. Lastly, some experiments were done to decide whether the *in vitro* addition of insulin would modify the effects of plasma on the hexokinase activity of rat brain extracts.

For each experiment 4-7 consecutive blood samples were withdrawn from the same subject at certain intervals, and their effects were determined using the same rat tissue extract whose normal hexokinase activity was obtained in a control run. It was possible to study in this way if and how the effects could be varied by the application of metabolic or stressful stimuli, viz., mixed meals, an oral test dose of glucose, electric convulsion therapy (E.C.T.) or

insulin hypoglycaemia. In every experiment the first blood specimen was taken from the fasting subject before the stimulus was applied. The spontaneous variation under basal conditions was investigated in a series of experiments in which an average of 6 blood specimens was collected from fasting subjects over a period of 3-4 hours.

The subjects were hospital patients (plus 1 member of the staff). They were grouped under the following diagnostic headings: organic disease, schizophrenia, depression, mania and psychoneurosis. The organic group consisted largely of cases of cerebral arteriosclerosis and senile dementia; it also includes 3 cases of epilepsy, 2 of confusional psychosis of unknown aetiology and 1 of delirium tremens. The schizophrenic patients were all recent admissions with the exception of a group of 10 patients, investigated in the series of glucose tolerance test experiments. This latter group consisted of patients with a history of several years of hospitalization. Most of them were in a chronic state of catatonia and the group will therefore be referred to as "catatonic."

Table I shows the number of cases investigated in each series of experiments, together with the number of blood samples studied in each experiment and the intervals at which samples were collected. The following particulars may be added:

Fasting subjects.—In 7 cases 7 blood samples were collected at half-hourly intervals, and in 3 cases 4 samples at hourly intervals. In the remaining 5 cases 5 or 6 samples were collected over a period of 3-4 hours.

Effects of mixed meals.—In this group 4 blood samples were collected at two-hourly intervals, starting at about 7 a.m. The first sample was taken from the fasting subject, but the usual hospital meals were allowed thereafter (meal times 8 a.m. and 12 noon).

Effects of oral glucose test doses.—For these tests a blood sample was collected from the fasting subject immediately before glucose administration; further specimens were withdrawn at 30, 60, 90, 120 and 180-minute intervals after the ingestion of a dose of 50 gm. glucose dissolved in 0.5 pint of water. No further meals were allowed during this period.

The series includes 6 experiments in which a second dose of 50 gm. glucose was administered 30 minutes after the first dose (Exton-Rose glucose tolerance test). The results were combined with those of the single-dose test.

Effects of E.C.T.—Blood specimens were withdrawn immediately before and 10, 30, 60, 90, 120 and 180 minutes after the application of the current. No food was allowed during this period. In most cases the treatment consisted in the administration of a single shock; in 1 case 3 successive shocks were given. Two experiments were performed on patients who received E.C.T. while under the influence of pentothal and C 10 (decamethonium iodide).

Effects of insulin hypoglycaemia.—The experiments were carried out on patients undergoing insulin shock therapy. In one series of 26 cases 4 blood samples were collected as follows: (1) before insulin injection (sample No. 1), (2) 2 hours after insulin injection (sample No. 5), (3) during coma (sample No. 6), and (4) 1 hour after termination of coma (sample No. 7). Also included were some sporadic samples, corresponding to samples Nos. 5, 6 or 7 of a

complete experiment. In a second series of 7 cases, 2 or 3 additional samples (Nos. 2-4) were taken at half-hourly intervals after the injection of insulin. Insulin was injected intramuscularly, and the doses ranged from 30 to 220 units. The number of coma treatments undergone by a patient before the experiment ranged from 1 to 84.

In 2 cases of psychoneurosis insulin was injected intravenously (0.1 unit/kgm.), and blood was taken before, and 10, 30, 60, 90, 120 and 180 minutes after the injection.

METHODS.

Blood samples of 5 ml. were collected by venous puncture and delivered into a 10-ml. bottle containing 15 mgm. NaF and 1-2 glass beads. The bottle was gently inverted for several minutes and plasma was separated by centrifugation. Haemolysates were prepared as previously described (Weil-Malherbe and Bone, 1951*b*). The effect of plasma or haemolysate on the activity of hexokinase was tested by adding 1 ml./3 ml. of total volume.

The preparation of rat brain extracts and the composition of the test solution were the same as previously described (Weil-Malherbe and Bone, 1951*a*). Rat muscle extract was prepared by grinding cooled rat muscle in a Latapie mill, stirring with 1.5 vol. 0.033 M NaHCO_3 solution for 15 minutes at 0° and centrifuging. The supernatant was diluted with an equal volume of glass-distilled water before use. Rats of both sexes from an inbred brown and white strain, reared on a diet of "Rat Cubes" (North-Eastern Agricultural Co-operative Society, Aberdeen), were used at the age of 2-3 months.

In the presence of plasma the test solution was modified to allow for the content of magnesium, bicarbonate, fluoride and glucose of the plasma added. The amounts of the 3 mineral constituents, added in presence and absence of plasma, are indicated in Table II. Where the plasma glucose exceeded 100

TABLE II.—*Modification of Test Solution in the Presence of Plasma.*

Component solution.	In absence of plasma.		In presence of plasma.	
	Concentration of stock solution (gm./100 ml.).	ml. added (per 3 ml. total volume).	Concentration of stock solution (gm./100 ml.).	ml. added (per 3 ml. total volume).
NaHCO_3	5.05	0.1	3.85	0.1
$\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$	4.1	0.1	3.5	0.1
NaF	3.0	0.1	—	0

mgm. per cent. the glucose content of all parallel experiments in the same run was raised to an identical level and the concentration of ATP was increased in the same proportion. When the blood sugar was above 200 mgm. per cent. the protein concentration of the enzyme solution was doubled.

Owing to the high affinity of hexokinase for glucose the enzyme is saturated at very low substrate concentrations, viz., at about 1-2 mgm. per cent. of glucose (Weil-Malherbe and Bone, 1951*a*), and as long as the glucose concentration does not fall below this level the reaction rate is independent of the actual concentration of glucose. Even appreciable variations of the initial glucose level would therefore not affect the result.

The reaction rate was measured by the rate of glucose disappearance, a method which only estimates the activity of hexokinase independently of the activities of other enzymes present. Glucose was determined in duplicate according to Nelson (1944) after $\text{Ba}(\text{OH})_2 - \text{ZnSO}_4$ precipitation. To start the reaction the brain or muscle extract was the last component added. An initial sample of 1 ml. was immediately withdrawn and delivered into a solution of ZnSO_4 (1 ml. 5 per cent. solution + 7 ml. water). At the end of the incubation period, usually 20 to 30 minutes, a final value was similarly determined. Incubations were carried out at 30° in an atmosphere of $\text{N}_2 + 5$ per cent. CO_2 .

Addition of insulin in vitro.—Insulin hydrochloride was a B.D.H. preparation with a zinc content of 0.035 per cent. and an activity of 20–21 units/mgm. The amount added per 3 ml. of total volume was 0.1 mgm.

Experimental error.—A measure of the experimental error was obtained by the statistical analysis of 50 pairs of duplicate experiments. A standard deviation of 6.55 per cent. was found. Deviations $\geq \pm 17$ per cent. from the control experiment may therefore be regarded as significant ($P \leq 0.01$). These experiments were done in the early stages of the investigation; since then improvements in technique and growing experience have probably reduced the experimental error still further.

Expression of results.—The effects of plasma or haemolysate on hexokinase activity were expressed in relation to the activity of the control experiment. Activation effects were calculated as percentage deviations from the control and are presented as positive figures, ranging from 0 to about 500. It was considered desirable to express inhibition effects in a way comparable to that used in the presentation of activation effects. For this purpose a $0 - \infty$ scale seemed most appropriate, as in both cases corresponding increases of activation or inhibition are expressed by similar numerical increments. The difference between control and inhibited activity was therefore calculated as a percentage of the inhibited activity, and is presented by negative figures. Denoting the activity of the control experiment by A_c and that of the test experiment, containing an additional component, by A_t ,

$$\begin{aligned} \text{activation } (A_t > A_c) &= (A_t/A_c - 1)100 \\ \text{and inhibition } (A_t < A_c) &= -(A_c/A_t - 1)100. \end{aligned}$$

The ideal procedure would be to express the activation observed in relation to the maximum activation theoretically possible and to construct a similar scale for the inhibition effects, but this is obviously impossible in practice.

The extent of acceleration or inhibition of hexokinase activity is thus quantitatively expressed by a positive or negative figure; activation effects above $+17$ and inhibition effects below -17 are regarded as significantly outside the limits of experimental error, whereas effects within the range from -17 to $+17$ are regarded as not significant.

A measure of the individual response to any given stimulus is obtained by the difference between the lowest and the highest figure recorded for the effects of a series of consecutive samples withdrawn from the same subject during an experiment. This will be called the "maximal individual variation." To

quote an example, in an experiment on a patient having E.C.T. the following figures were obtained for the effects of consecutive plasma samples on brain hexokinase: — 5, — 25, — 52, — 43, — 11, + 24, + 44; the maximal individual variation is 96.

Mean values are given together with their standard errors.

TABLE III.—*Frequency of Activation and Inhibition Effects Observed with Consecutive Plasma Samples.*

Experiment.	Diagnostic group.	Effect.	Frequency of occurrence in sample No.							Total.
			1	2	3	4	5	6	7	
Fasting subjects	—	N.S.*	10	10	11	9	10	7	5	62
		Activation	3	5	3	5	4	4	2	26
		Inhibition	2	0	1	1	0	0	0	4
		Total	15	15	15	15	14	11	7	92
Mixed diet	—	N.S.*	6	3	3	6				18
		Activation	7	11	11	7				36
		Inhibition	2	1	1	1				5
		Total	15	15	15	14				59
Glucose tolerance test	1. Organic group	N.S.*	9	4	4	7	7	2		33
		Activation	0	2	2	1	4	3		12
		Inhibition	2	5	5	3	0	6		21
		Total	11	11	11	11	11	11		66
	2. Depressions	N.S.*	13	5	7	5	10	9		49
		Activation	0	8	4	6	4	3		25
		Inhibition	3	2	5	4	2	4		20
		Total	16	15	16	15	16	16		94
	3. Schizophrenics (recent)	N.S.*	3	3	1	3	5	2		17
		Activation	1	2	3	1	0	2		9
		Inhibition	1	0	1	1	0	1		4
		Total	5	5	5	5	5	5		30
	4. Psychoneuroses	N.S.*	5	0	2	3	2	2		14
		Activation	0	4	3	1	3	3		14
		Inhibition	0	1	0	1	0	0		2
		Total	5	5	5	5	5	5		30
	5. Catatonics	N.S.*	10	8	8	10	10	8		54
		Activation	0	2	2	0	0	1		5
		Inhibition	0	0	0	0	0	1		1
		Total	10	10	10	10	10	10		60
E.C.T.	—	N.S.*	9	5	4	5	8	4	5	40
		Activation	2	5	4	3	4	5	5	28
		Inhibition	1	2	4	4	0	3	2	16
		Total	12	12	12	12	12	12	12	84
Insulin (coma)	—	N.S.*	16	4	3	5	12	14	11	65
		Activation	10	2	1	0	16	16	13	58
		Inhibition	7	1	2	1	10	8	10	39
		Total	33	7	6	6	38	38	34	162

* N.S. = Not significant.

RESULTS.

I. Plasma Effects.

1. The Extent of Spontaneous Variation.

When blood samples were withdrawn at intervals from fasting subjects, addition of plasma to rat brain extract had no marked influence on hexokinase activity. The resulting curves were flat, showing only insignificant fluctuations, regardless of the diagnostic group to which the subject belonged. Table III shows that the proportion of significant activation or inhibition effects was small, and did not change appreciably during the experiment. Similarly, the mean value of the maximal individual variation was comparatively small (Table IV).

TABLE IV.—Maximal Individual Variations (Mean Values) of Plasma Effects Observed in Different Series of Experiments.

Experiment.	Diagnostic group.	Number of cases.	Mean number of samples/case.	Maximal individual variation of effects (mean).	Range.
Fasting subjects	—	15	5.9	25.5 ± 2.7	9-39
Mixed diet.	—	15	4	60.5 ± 11.4	20-148
Glucose tolerance test	1. Organic group	11	6	71.3 ± 9.5	25-119
	2. Depressions	16	5.9	71.3 ± 12.6	16-192
	3. Schizophrenics (recent)	5	6	51.6 ± 12.9	18-96
	4. Psycho-neuroses	5	6	46.4 ± 14.0	14-93
	5. Catatonics	10	6	20.5 ± 2.4	10-36
E.C.T.	—	12	7	49.1 ± 7.1	23-96
Insulin (coma)	—	33	4.6	110 ± 13.4	17-288

When the effects of the first plasma sample were compared with those of the second, a slight increase was found in 11 cases and a slight decrease in 4 cases. The mean of the 15 cases was $+0.67 \pm 4.55$ for the effects of the first sample, $+9.07 \pm 4.30$ for those of the second sample, and $+9.30 \pm 4.70$ for those of the fifth sample. The increase of the second over the first sample is statistically significant ($t_{(N=14)} = 33.3$, calculated by the formula for paired variables; $P < 0.01$), whereas there is obviously no significant difference between the second and fifth samples. If, as we suppose, the inhibitory effects are linked to the activity of the pituitary-adrenocortical system, the lower figures obtained with the first sample, withdrawn in the early morning, may be connected with the early morning peak of pituitary-adrenocortical activity (Pincus, 1943; Pincus, Romanoff and Carlo, 1948).

The first samples of the other experiments, excluding only the series on subjects in insulin coma and on diabetics, provide additional material for the assessment of effects observed under basal conditions. Out of a total of 77 cases 55 showed no significant effects, 13 caused activation and 9 caused inhibition. The mean value of these 77 observations is 2.8 ± 3.46 ; there is

thus no significant effect on the average. The corresponding figures for 33 pre-injection values from the series of insulin hypoglycaemia experiments are 0.67 ± 12.25 , showing that there is a much larger scatter. This may be attributed to the after-effects of hypoglycaemic comas preceding the experiment.

2. *The Effects of Mixed Meals.*

It appears from Table IV that the mean maximal individual variation in this group is significantly higher than in the fasting series ($t_{(N=28)} = 2.99$, $P < 0.01$), and it may be concluded that this increase is due to the metabolic stimulus of food. The data in Table III show that the frequency of significant activation effects increases in the second and third samples. Compared with the fasting samples of the same series the increase in frequency is of doubtful significance ($\chi^2_{(N=1)} = 3.10$, $P = 0.075$), but compared with the aggregate of results obtained in the series of experiments on fasting subjects it is highly significant ($\chi^2_{(N=1)} = 19.3$, $P < 0.01$).

The number of blood samples per subject was too small and the interval between collections too long to recognize characteristic recurring reaction patterns in this series. One fact deserves emphasis: the rarity with which inhibition effects were observed. In particular, there was no increase in the frequency of inhibition effects in response to the metabolic stimulus.

3. *The Effects of Oral Glucose Test Doses.*

In this series of experiments the results shown in Tables III, IV and V are given separately for 5 diagnostic groups, not only because this series is more extensive than the others, but mainly because definite differences between the groups were observed.

As far as the mean maximal individual variations are concerned (Table IV), there is no significant difference either between the first 4 groups themselves or between these groups and the series of mixed-meal experiments. On the other hand, the differences between any of the first 4 groups and either the series of fasting subjects or the catatonic group are highly significant (e.g., group 3 and group 4 combined, compared with group 5, gave $t_{(N=17)} = 3.03$; $P < 0.01$). The catatonic group gave curves rather like those of the fasting group and was remarkable for its relative lack of response to the stimulus. A single case of mania, not included in the data, gave a similarly flat curve with a maximal individual variation of 18 in 6 samples.

While groups 3 and 4 of this series resemble the mixed-meal series in a tendency to respond to the stimulus with an increased frequency of activation effects (Table III), groups 1 and 2 differ from them by reacting to the stimulus with a definite increase in the frequency of inhibition effects. Comparing the combined post-glucose observations of groups 1 and 2 with those of the remainder of the series, the difference in frequency of inhibition effects is highly significant ($\chi^2_{(N=1)} = 17.0$; $P < 0.01$). The same is true when comparison is made with the mixed-meal series ($\chi^2_{(N=1)} = 8.7$; $P < 0.01$).

When the observations on the effects of plasma were plotted against the time of withdrawal of the blood sample, characteristic reaction patterns were

TABLE V.—*Types of Reaction Patterns Observed in Response to Stimuli.*

Experiment.	Diagnostic group.	Frequency of occurrence.					Total.
		Monophasic : activation. Λ_{-}	Monophasic : inhibition. V^{-}	Biphasic : activation- inhibition. $\Lambda_{-}V^{-}$	Biphasic : inhibition- activation. $V_{-}\Lambda$	Flat or atypical curve.	
Glucose tolerance test	1. Organics	.	.	.	.	.	11
	2. Depressions	.	2	3	5	0	16
	3. Schizophrenics	.	4	4	0	1	5
	(recent)	2	0	0	2	1	
	4. Psychoneuroses	.	0	1	0	3	5
E.C.T. Insulin (coma)	5. Catatonics	.	0	0	0	7	10
	—	3	5	3	0	1	12
	—	12	10	1	2	5	30

formed. These were either monophasic or biphasic. The monophasic reaction showed either an activation or an inhibition peak. In the biphasic reaction activation was followed by inhibition or vice versa. Table V shows the frequencies with which these four patterns were observed, and typical examples are shown in Figs. 1-4. The fifth column of Table V contains the number of experiments in which a characteristic response was absent.

Correlation between blood-sugar rise and plasma effects.—It was found that in many of the organic and depressive cases in which marked inhibition effects

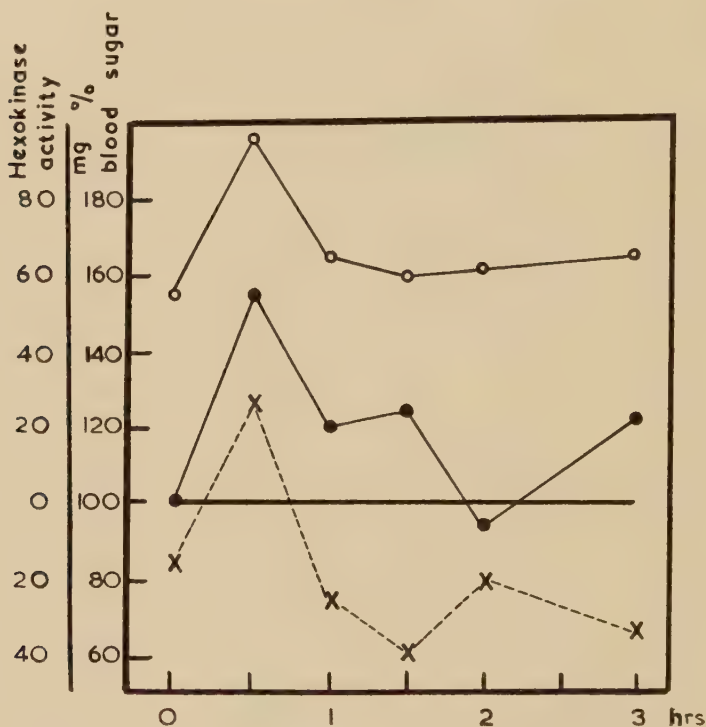


FIG. 1.—Effects of plasma and haemolysate on rat brain hexokinase after oral glucose test dose. ●—● Brain hexokinase activity in presence of plasma. ○—○ Brain hexokinase activity in presence of haemolysate. × — — × Blood glucose. Case of agitated depression, female, aged 38. Monophasic reaction pattern with predominant activation effect.

were observed the rise of the blood-sugar curve after the glucose test dose was high and the return to fasting level often delayed, a form of response not uncommon in these cases (see McFarland and Goldstein, 1939, and Holmgren and Wohlfahrt, 1944, for reviews of the literature). Frequently, the peak of the blood-sugar curve coincided with the maximum of inhibition (cf. Figs. 2, 3 and 6). On the other hand, many of the cases of the other 3 groups not only showed a slight rise of the blood-sugar curve, but often also an unusually low level of the fasting blood sugar. These facts suggested a correlation between the occurrence of activation effects and a flat blood-sugar curve on the one hand, and the occurrence of inhibition effects and a high and sustained blood-sugar

curve on the other. For each sample the difference of the blood sugar from the fasting level was arrayed against the value of the plasma effect on hexokinase activity, and the linear regression coefficients of the 5 post-glucose samples were calculated for the combined results of the 5 diagnostic groups. As may be seen from Table VI and Fig. 5, there is a highly significant regression in the

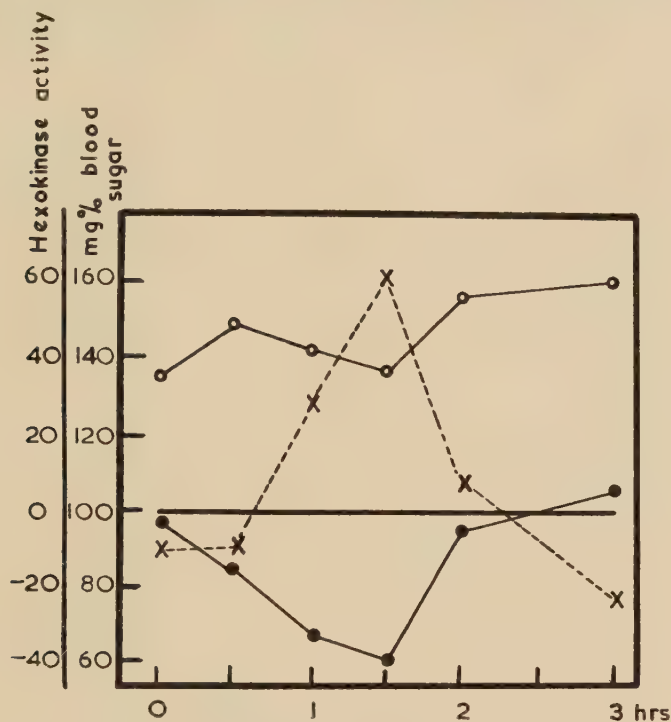


FIG. 2.—As Fig. 1. Case of involutional depression, male, aged 67. Monophasic reaction pattern with predominant inhibition effect.

1-hour and the 3-hour samples, while the regression in the other samples is probably significant.

TABLE VI.—*Correlation of Plasma Effects with Blood-sugar Changes After an Oral Glucose Test Dose.*

Blood sample minutes after glucose administration.	Number of observations.	Linear regression coefficient.	<i>t</i> .	<i>P</i> .
30	47	-0.457 ± 0.181	2.52	0.012
60	48	-0.631 ± 0.125	5.06	<0.01
90	46	-0.195 ± 0.096	2.04	0.04
120	48	-0.139 ± 0.061	2.25	0.025
180	48	-0.644 ± 0.207	3.1	<0.01

While a high and sustained blood-sugar rise after a glucose test dose is often indicative of high pituitary-adrenocortical activity, a slight blood-sugar rise and a fasting hypoglycaemia suggests a hypofunctional state of the pituitary-

adrenocortical system. Similarly, inhibitory effects on hexokinase activity may perhaps be associated with pituitary adrenocortical activity and activating effects with the activity of antagonistic systems.

4. *Effects of E.C.T.*

The mean value of the maximal individual variation in this series (Table IV) is significantly higher than the spontaneous variation in fasting subjects

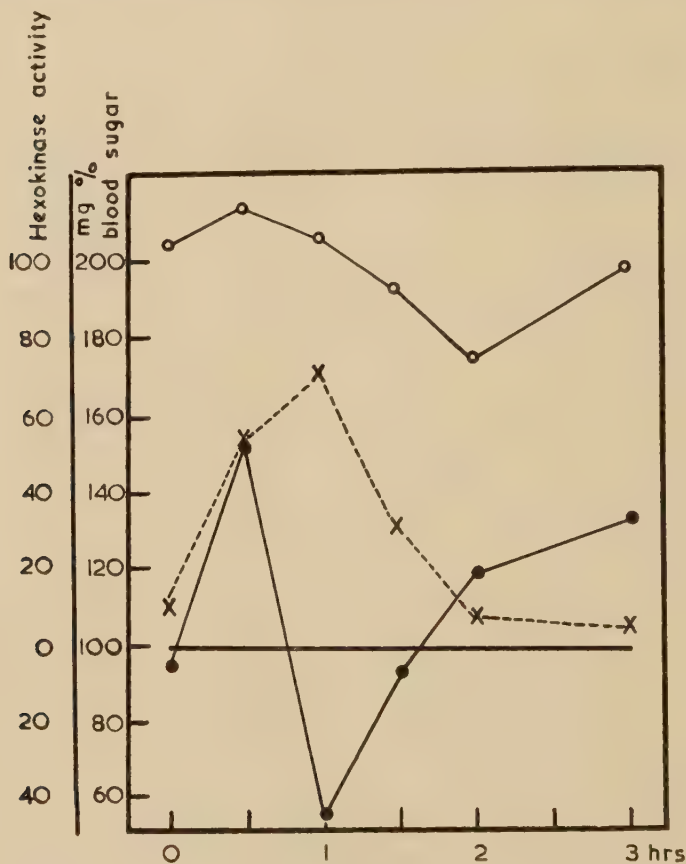


FIG. 3.—As Fig. 1. Case of cerebral arteriosclerosis with confusion, female, aged 65. Biphasic reaction pattern ("activation-inhibition").

($t_{(N=25)} = 3.1$; $P < 0.01$), indicating an effect of the treatment on the concentration of active factors in plasma. An increase in the frequency of both activation and inhibition effects was observed (Table III) with monophasic and biphasic response patterns (Table V). As is well known (Castelluci, 1940), the treatment was usually followed by a more or less transient blood-sugar rise. This was absent in two patients who had E.C.T. while under the influence of pentothal and C10 (decamethonium iodide), in agreement with the observations of Piette (1950), who showed that the suppression of the blood-sugar rise is due to the injection of pentothal. In both these patients no significant

effects were observed in the first 90 minutes after the shock, but significant inhibitions were caused by the 2- and 3-hour samples.

5. *Effects of Insulin Hypoglycaemia.*

The highest value of the mean maximal individual variation was obtained in this series in spite of the smaller number of samples per subject (Table IV). This

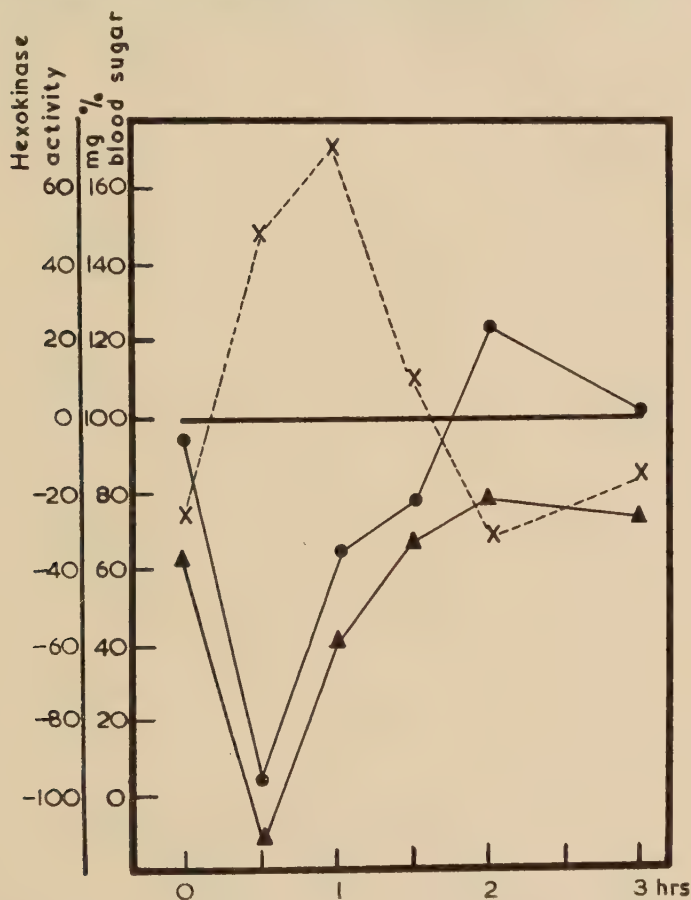


FIG. 4.—Effects of plasma on rat brain and muscle hexokinase after oral glucose test dose. ●—● Brain hexokinase activity. ▲—▲ Muscle hexokinase activity, both in presence of plasma. × — — × Blood glucose. Case of depression with anxiety and hypertension, male, aged 62. Biphasic reaction pattern ("inhibition-activation").

result is not so much due to an increasing frequency of activation or inhibition effects as to a greater intensity of these effects when they occurred. The prevalent reaction patterns were monophasic (Table V), but this may be connected with the smaller number of samples per subject in this series. Since most of the subjects were schizophrenics, it is not surprising that no significant effects were observed in about one-third of the cases. Of the remaining two-thirds activation effects were most frequent amongst women and in-

hibition effects amongst men. Sex differences in the blood-sugar curve following insulin coma were reported by Heiman (1941). One young man suffering from a confusional episode of unknown nature showed a particularly strong inhibitory response on two separate occasions. He made a complete recovery.

In two cases where a small dose of insulin (0.1 unit/kgm.) was injected intravenously a typical hypoglycaemic response was observed after 10 minutes. The plasma effect on hexokinase activity was inhibitory in the 30-minute samples (—30 and —40 respectively), but insignificant in later samples.

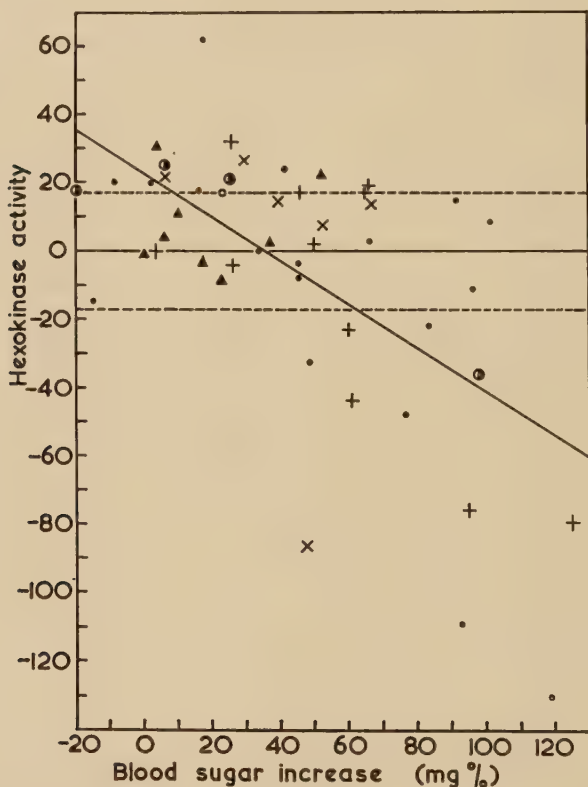


FIG. 5.—Regression of plasma effects on blood-sugar rise. Blood samples collected 60 min. after oral glucose test dose. The dotted lines indicate the margins of significance for deviations from the base line; the diagonal line is the calculated linear regression. Key: + organic group; . depressions; x schizophrenias (recent); ● psychoneuroses; ▲ catatonics; ○ mania.

6. *In vitro Effects of Insulin.*

Since insulin has been reported to relieve the inhibition of hexokinase activity caused by a pituitary factor (Colowick *et al.*, 1947), it was of interest to investigate whether the effects of plasma on the hexokinase activity of rat-brain extracts could be modified by the *in vitro* addition of insulin. The effects of 59 samples of plasma were studied in presence and absence of insulin. Significant inhibitions were caused by 17 samples and significant activations by 12 samples, in the absence of insulin. As ascertained previously (Weil-Malherbe and

Bone, 1951a), insulin alone does not affect the hexokinase activity of rat brain extracts.

The mean value of the 59 observations, -10.5 , is raised almost to the base line in presence of insulin (Table VII). The increase, when tested by the formula for paired variables, is found to be significant. When inhibition and activation effects are separated from the total and tested singly, it appears that insulin caused a highly significant decrease of both effects and, on the basis of these results, it seems justified to conclude that insulin *in vitro* antagonizes both the

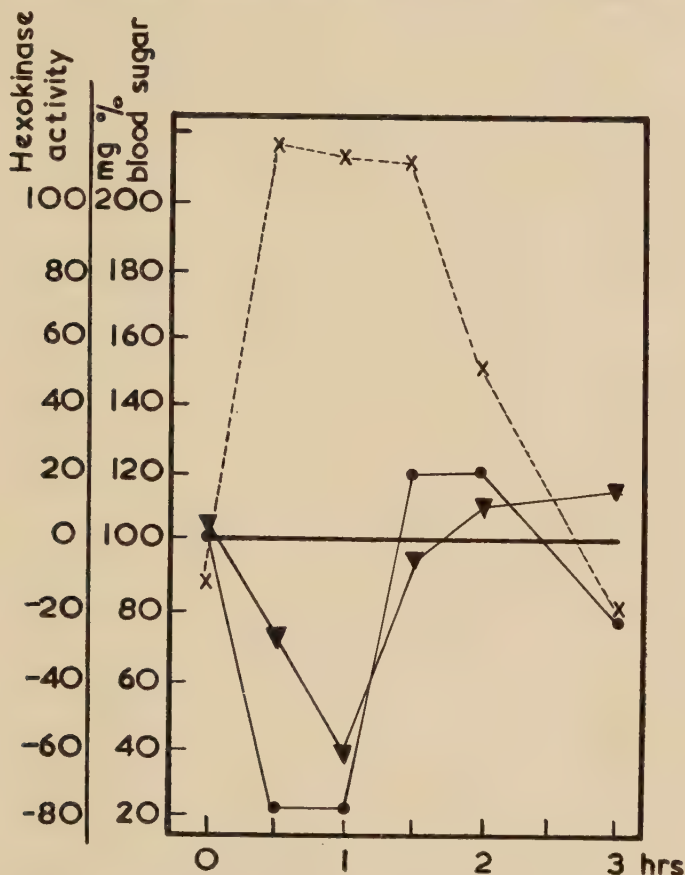


FIG. 6.—Effects of plasma on rat brain hexokinase after oral glucose test dose, in presence (▼—▼) and in absence (●—●) of insulin (2 units/3 ml., added *in vitro*). X—X—X Blood glucose. Case of epilepsy, female, aged 69. Biphasic reaction pattern ("inhibition-activation").

TABLE VII.—Variation of Plasma Effects by the *in vitro* Addition of Insulin (2 units/3 ml.).

	Number of samples.	Mean value of plasma effects.		<i>t</i> .*	<i>P</i> .
		Without insulin.	With insulin.		
Total of observations	59	-10.52 ± 5.26	-0.96 ± 4.54	2.78	<0.01
Inhibitions	17	-53.6 ± 10.66	-21.1 ± 12.10	78.2	<0.01
Activations	12	27.5 ± 4.03	18.7 ± 7.40	22.0	<0.01

* Calculated by formula for paired variables.

inhibition and activation effects of plasma. Neither of these effects are, however, completely neutralized by the addition of insulin. An example of an observation with added insulin is shown in Fig. 6.

II. *Haemolysate Effects.*

In an earlier publication (Weil-Malherbe and Bone, 1951*b*) an activator of hexokinase, present in human red blood cells, was described. The paper included data on the frequency distribution of the effect, based on over 300 different samples of human haemolysates. The peak of the curve lay at a point corresponding to 100 per cent. activation, but there was a considerable scatter. Activations of up to 500 per cent. were observed in some experiments, while in others the effect was insignificant or absent; occasionally, addition of haemolysate was even found to cause inhibition.

The question arose whether the variability of the haemolysate effects could be attributed to the same factors as those which cause the plasma effects. Their action might conceivably be superimposed on the effect of a more stable activator and modify it more or less. The experience that different samples of haemolysate from the blood of the same individual withdrawn at short time intervals often varied considerably in their effects on hexokinase seemed to support this assumption, as it indicated the transient and changeable nature of some component.

When the haemolysate effects were compared with the plasma effects, it was sometimes found that the two curves ran parallel though on different levels (see, e.g., Fig. 1). For each experiment, therefore, the initial effect was subtracted from each of the subsequent effects, and the resulting variations of plasma effects were arrayed against the variations of the haemolysate effects. In this array each pair of figures referred to observations made with plasma and haemolysate prepared from the same blood samples. The comparison, based on an aggregate of 364 pairs of observations, did not, however, establish a significant correlation. Whether this is due to the different nature of the active factors or to their different distribution, different mode of action or lack of synchronism in the two blood fractions cannot be decided at present.

It was not possible, either, to find a significant relation between the mean values of the maximal individual variation and the application of metabolic or stressful stimuli (Table VIII); the only significant increase of variation over the basal variation in fasting subjects is that in the series of observations on insulin hypoglycaemia ($t_{(N=33)} = 3.15$; $P < 0.01$).

TABLE VIII.—*Maximal Individual Variations (Mean Values) of Haemolysate Effects.*

Experiment.	Number of cases.	Mean number of samples/case.	Maximal individual variation of effects (mean).	Range.
Fasting subjects	7	6.4	40.2 ± 6.78	17-69
Mixed diet	15	3.9	60.5 ± 14.13	9-226
Glucose tolerance test	15	5.9	32.8 ± 4.71	6-70
E.C.T.	10	7	62.5 ± 10.80	28-134
Insulin (coma)	25	4	78.7 ± 10.50	13-206

III. *Correlation of Effects on Brain Hexokinase and on Muscle Hexokinase.*

For reasons stated in the introduction rat brain extract was chosen as a source of hexokinase for the bulk of the experiments. It was, however, of interest to know whether the effects described were confined to brain extracts, or whether they could also be observed with hexokinase of a different origin. In a series of experiments the same samples of plasma or haemolysate were

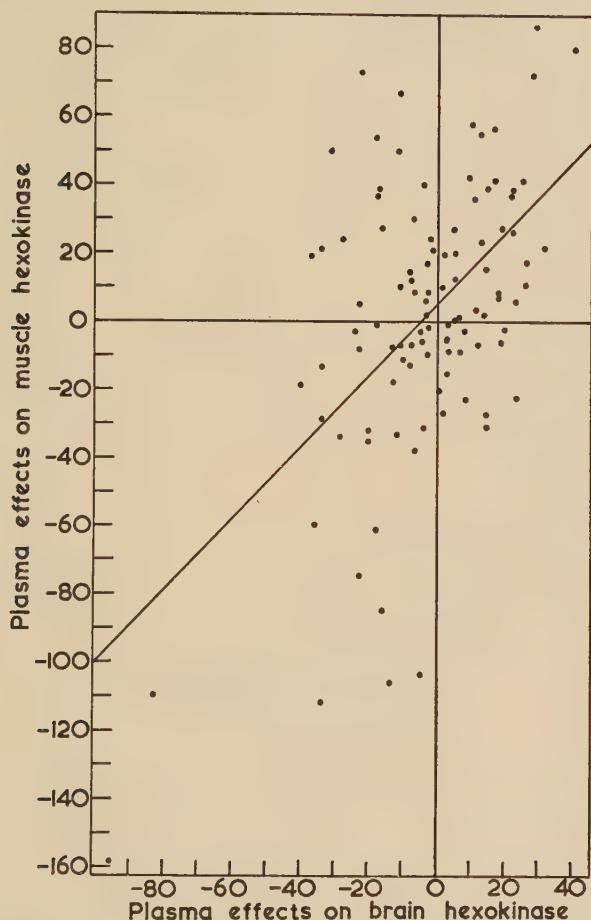


FIG. 7.—Regression of activation or inhibition of muscle hexokinase on activation or inhibition of brain hexokinase by identical plasma samples. The diagonal line is the calculated linear regression.

therefore added to both rat brain and rat muscle extracts, and their effect on the hexokinase activity of these preparations investigated. The plasma experiments numbered 17, of 6 samples each, a total of 102 observations. An example of an actual experiment is shown in Fig. 4.

When the plasma effects on brain hexokinase were arrayed against those on muscle hexokinase, a significant correlation could be established, in spite of a considerable scatter (Fig. 7). The linear regression coefficient is 1.053 ± 0.156

($t_{(N=100)} = 6.7$; $P < 0.01$). The regression coefficient of 1 indicates that, at least statistically, the relative sensitivity of both enzymes to activation and inhibition effects is the same. This is of importance for the possible significance of the plasma effects *in vivo* since, even if the active factors are debarred from contact with brain hexokinase by the blood-brain barrier, they would presumably be able to influence the hexokinase activity of other tissues.

Similar experiments, though only 3 in number, comprising 18 observations, were carried out with haemolysates (Fig. 8). The results were almost identical with those of the plasma experiments; the linear regression coefficient found was 0.915 ± 0.128 ($t_{(N=16)} = 7.16$, $P < 0.01$), indicating again a statistically equal response of both enzymes.

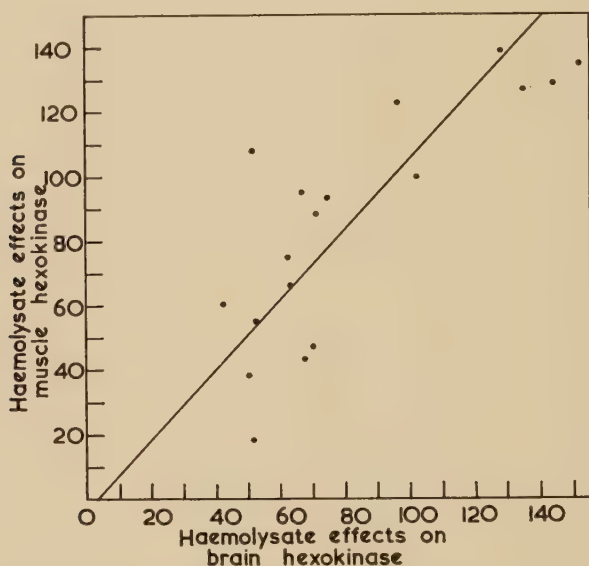


FIG. 8.—Regression of activation of muscle hexokinase on activation of brain hexokinase by identical haemolysate samples. The diagonal line is the calculated linear regression.

IV. Observations in Diabetics.

Results obtained with diabetics are included in this paper because of their bearing on the hypothesis of the hormonal origin of the inhibitors and activators of hexokinase in blood. Unfortunately the material at our disposal was limited to a few elderly mental patients with incidental diabetes and to a few cases under treatment at a general hospital. A preliminary note on this work has appeared elsewhere (Weil-Malherbe, 1950).

The experiments were done under the same conditions as those used for the study of the effects of a mixed diet in non-diabetic mental patients; a first blood specimen was collected before breakfast and three more samples at two-hourly intervals. The results of the series on the effects of mixed meals may therefore be regarded as a non-diabetic standard.

When a diabetic patient was treated with insulin, the treatment was

interrupted before the experiment. Injections were stopped for 3 days in the case of protamine-zinc-insulin and for 24 hours in the case of standard insulin. Some of the cases were reinvestigated during insulin treatment.

The results fall into two classes: those in which one or more of the plasma specimens contained an inhibitor of hexokinase in appreciable concentration (Table IX) and those which did not show any unusual inhibitory effects (Table X). Only the cases of the first category were reinvestigated during insulin treatment. The injections of insulin were usually given between the collections of the first and second blood specimen. It is evident from Table IX that the inhibitory effects of plasma were reduced or disappeared, or were replaced by activation after the injection of insulin.

The strongest inhibitions observed occurred in this series. Case 1 was admitted with an undiagnosed severe diabetes and the first experiment was performed before insulin treatment had begun. Experiment 2 was carried out after a suitable insulin-free interval, when the patient's physical condition had greatly improved. At that time the inhibitory effects, though still apparent, were smaller. Whether this was due to a recovery of endogenous insulin secretion, or whether the decrease of inhibition observed in diabetics under insulin treatment is due to secondary factors which may persist for some time in absence of exogenous insulin, cannot be decided. In Case 2, who had been maintained by insulin for years, a moderate inhibitory reaction was repeatedly found whenever insulin was suspended, while activation effects were observed after insulin injection.

Inhibition, when present, was usually strongest in the second or fourth sample, i.e., after the morning or midday meal. There is, however, no obvious correlation between blood-sugar level and inhibition, and the effects of insulin in particular were apparent even when the effects on the blood-sugar level were slight.

With one exception (Case 5, exp. 1) haemolysates of diabetics showed the usual activating effects.

DISCUSSION.

Before examining the proposition that the activators and inhibitors of hexokinase in human blood are of hormonal origin, it is perhaps appropriate to inquire into the possible mechanisms by which hormones could regulate the rate of enzymic reactions. While different reaction rates may be largely attributed to the different mutual accessibility of the reaction partners where heterogeneous systems are concerned, this factor may be taken as constant in homogeneous systems. The activity of an enzyme in the presence of a saturating concentration of substrate depends on the concentration of its functional groups, and inhibition or activation effects on enzymes in solution are usually interpreted as a blocking or unblocking of functional groups. An enzyme solution capable of activation is thus supposed to contain a reserve of temporarily non-functional, potentially active groups. The molecules are assumed to follow the all-or-nothing rule: they are either fully active or fully inactive.

Useful as this concept is, it is doubtful if it is adequate. An increase in the

TABLE IX.—*Effect of Blood Fractions of Diabetic Patients on Rat Brain Hexokinase.*

First blood sample taken from fasting subject, the following samples after mixed meals.

Exp. No.	Insulin administered.	Sex.	Age.	Psychiatric diagnosis.	Insulin requirement (unit/day).	Effect on hexokinase.											
						Blood sugar (mgm. per cent.)				Plasma.				Haemolysate.			
						Sample No.				Sample No.				Sample No.			
1	—	Male	73	Depression	65	1	2	3	4	1	2	3	4	1	2	3	4
2	—					285	410	353	450	—87	—366	—289	—584	9	75	77	141
3	+					270	425	440	430	19	19	—9	—85	124	132	115	109
						215	443	240	201	—148	—39	—47	—16				
4	—	"	63	Involuntary depression; cerebral arteriosclerosis	35	1	2	3	4	1	2	3	4	1	2	3	4
5	—					214	334	284	300	5	—14	—39	—86	81	105	256	180
6	+					206	260	230	274	—35	—56	—50	—16	105	146	188	155
7	+					180	165	87	160	3	81	17	90	54	65	44	30
						167	135	54	91	47	57	53	37	347	360	370	420
8	—	"	37	—	40	1	2	3	4	1	2	3	4	1	2	3	4
9	+					252	294	337	314	28	—164	—23	27	>55	>58	>32	>37
						167	272	249	242	46	—52	71	—22	74	206	140	266
10	—	Female	67	Senile dementia	0	1	2	3	4	1	2	3	4	1	2	3	4
11	—					152	250	214	230	—64	—23	—19	—43	—30	58	56	51
						173	173	133	170	9	—60	—115	—115	9.5	30	30	47
12	—	"	47	—	90	1	2	3	4	1	2	3	4	1	2	3	4
13	+					316	254	204	182	—28	—56	—19	—215	4	12	—4	—39
						145	163	161	174	—1	16	16	27	26	19	55	32
14	—	"	34	—	60	1	2	3	4	1	2	3	4	1	2	3	4
15	+					204	212	256	286	—82	—440	—201	—96	106	13	51	84
						208	282	242	268	40	29	119	—5	79	166	191	235
16	—	"	60	—	20	1	2	3	4	1	2	3	4	1	2	3	4
17	+					197	250	240	232	—7	—12	—36	—70	64	73	76	81
						234	252	280	298	14	—8	—12	—17	>96	>90	>83	82

TABLE X.—*Effect of Blood Fractions of Diabetic Patients on Rat Brain Hexokinase.*
Cases without unusual inhibition effects.

Exp. No	Sex.	Age.	Psychiatric diagnosis.	Insulin requirement (units/day).	Blood sugar (mgm. per cent.).				Effect on hexokinase.							
					Sample No.				Plasma.				Haemolysate.			
					1	2	3	4	1	2	3	4	1	2	3	4
1	Male	79	Cerebral arteriosclerosis	20	140	284	288	262	30	48	20	8	285	440	456	436
2	Female	62	Paraphrenia	40	207	217	245	—	50	69	27	—	—	—	—	—
3	"	63	—	20	179	209	186	190	—17	—20	—1	—4	76	173	140	87
4	"	63	—	40	330	342	286	348	147	156	105	128	85	102	129	122
5	"	37	—	25	296	364	472	336	19	19	26	34	25	7	39	49
6	"	79	Secondary dementia	0	123	235	132	166	—36	—17	—6	3	40	49	62	58
7	"	42	—	20	234	250	240	200	52	2	5	67	116	89	121	113

number of functional groups would certainly increase the reaction rate, but it is not the only possible mechanism of activation effects, especially if we take into account the large difference in size between enzyme and substrate molecules which introduces complications not usually present in truly homogeneous systems. Thus the reactive site may be situated inside the convolution of peptide chains that constitute the enzyme molecule and may be reached only with difficulty, or the substrate molecule may be affected in its approach to, or contact with, the reactive centre by the distribution of electric charges in the enzyme molecule. These factors might conceivably be influenced by a specific activator in such a way that the ratio of successful to unsuccessful collisions would increase. A single enzyme molecule, instead of being maximally active or completely inactive, might in such a case be able to function at variable speed.

A factor occurring in red blood cells, muscle and possibly other animal tissues, which activates hexokinase in solution, has recently been described (Weil-Malherbe and Bone, 1951*b*, *c*). It was found to be a protein and to be specific inasmuch as it acted only on hexokinase but not, e.g., on the related enzyme, phosphohexokinase, and was not replaceable by other proteins. No evidence whatever was found for the assumption that the activation was due to the removal of an inhibitor or to the protection of functional groups. When the enzyme solution was partly inhibited by the addition of glucose-6-phosphate, an inhibition which does involve the blocking of an active enzyme group, the inhibition was not reduced by the activator, but the uninhibited fraction of the enzyme molecules was activated to the same extent as the enzyme in a solution which contained no inhibitor. These results seem to us to support a mechanism of activation of the type outlined above.

The apparent ease with which the hexokinase activity of brain and muscle extracts can be changed by the addition of plasma or haemolysate might give rise to the impression that this is a very labile system easily swayed by un-specific factors. This is by no means the case. A large number of substances, many of them known to influence enzyme activity, were tested and were found to be without effect on brain hexokinase under our conditions (Weil-Malherbe and Bone, 1951*a*). Moreover, the relative lack of effects in experiments with the plasma of fasting and catatonic subjects underlines the significance of the effects in other experiments. Finally, the correlation of the effects on brain and muscle hexokinase also supports the conclusion that they were not due to chance variation.

The variability and transient character of the inhibitors and activators of plasma and their appearance in response to metabolic or stressful stimuli indicates a high degree of mobility and reactivity, such as might be expected if they were of hormonal origin. From their action in the intact animal or in surviving tissues it has been deduced that the hormones of the pituitary-adrenocortical system have an inhibitory effect, and that insulin has an activating effect on the hexokinase reaction (Cori, 1950). An examination of the data reported in this paper shows that inhibitory factors appeared in plasma under conditions which are known to stimulate the activity of the pituitary-adrenocortical system. These are: a glucose test dose in a fasting subject (Abelin,

1943 ; Elmadjian, Freeman and Pincus, 1946 ; Pincus, Hoagland, Freeman, Elmadjian and Romanoff, 1949), E.C.T. (Mikkelsen and Hutchens, 1948 ; Altschule, Parkhurst and Tillotson, 1949 ; Altschule, Altschule and Tillotson, 1949 ; Ashby, 1949), and hypoglycaemia (Gershberg and Long, 1948 ; Somogyi, 1948, 1949 ; Tsai, Bennett, May and Gregory, 1950 ; Dury, 1950), and the relative inhibition usually caused by the first blood sample, withdrawn from the fasting subject in the early morning, may perhaps be attributed to the early morning peak of adrenocortical activity (Pincus, 1943 ; Elmadjian and Pincus, 1946 ; Pincus, Romanoff and Carlo, 1948).

The correlation of the activating effects of plasma with insulin activity is less obvious. Activating effects were absent in many cases of insulin hypoglycaemia, even during the phase of decrease of the blood-sugar level. On the other hand, strong activation effects were found with some plasma samples of hypoglycaemic patients, and the activation effects observed in response to oral glucose test doses and their correlation with flat blood-sugar curves are also consistent with the stimulation of insulin production by glucose absorption (Foglia and Fernandez, 1936 ; Gomori, Friedman and Caldwell, 1939 ; Anderson and Long, 1948). Finally, the changes in the effects of diabetic blood following insulin treatment are in the expected direction ; these results are perhaps the strongest support so far for the hormonal nature of the blood factors affecting hexokinase activity.

Though the *in vitro* action of insulin on the inhibition effects of plasma is compatible with its function in carbohydrate metabolism, the slight but significant depression of activation effects is at present difficult to explain ; the possibility may perhaps be considered that it is due to an impurity such as the hyperglycaemic factor of the pancreatic alpha-cells.

One of the more consistent results was the absence of inhibitors in the blood of schizophrenics after glucose ingestion. In most of the more chronic cases neither activation nor inhibition effects were observed, and the flatness of the curves resembled those obtained with the blood of fasting subjects. These observations are in line with the lowered responsivity to stress of the adrenocortical system shown to exist in schizophrenia (Pincus, 1949 ; Pincus and Hoagland, 1950 ; Pincus, Hoagland, Freeman and Elmadjian, 1949).

It is difficult to account for the effects of plasma on hexokinase activity on a basis other than hormonal. Plasma is known to contain specific proteins acting as enzyme inhibitors, such as an inhibitor of trypsin (Landsteiner, 1900 ; Grob, 1943 ; Duthie and Lorenz, 1949) and of hyaluronidase (Glick and Moore, 1948), or enzyme activators such as thrombokinas, but these factors are fixed constituents whose concentration has not been shown to fluctuate as does that of the factors influencing hexokinase. A class of compounds other than hormones with variable concentration levels are the metabolites. Excepting adrenochrome (Meyerhof and Randall, 1948), which may be classed as a hormone, the only metabolite known to inhibit hexokinase is glucose-6-phosphate (Weil-Malherbe and Bone, 1951a). This compound, however, is largely intracellular. The concentration of all acid-soluble organic phosphates in plasma only corresponds to 0.6 mgm. P in 100 ml. (Stearns and Warweg, 1933). Even if this fraction consisted largely of glucose-6-phosphate, which is improbable, its

concentration would be insufficient to cause appreciable inhibition. On the other hand, the inhibition sometimes caused by a haemolysate in the series in which the effects of insulin shock therapy were studied might have been due to an accumulation of glucose-6-phosphate, since it is known that its intracellular concentration is increased by insulin (Kaplan and Greenberg, 1944).

It must be admitted that the evidence for the hormonal origin of the plasma effects on hexokinase is at present entirely circumstantial. Neither activation nor inhibition of hexokinase activity was found when insulin, adrenocortical extract (eschatin), crystalline deoxycorticosterone or cortisone was added to brain extract. It must therefore be concluded either that the effects are due to different hormones, such as the pituitary factor described by Colowick *et al.* (1947), or that the circulating hormone exists in an "active" form with properties different from those which it displays in glandular extracts. More information on this point may perhaps be obtained from experiments with diabetic, hypophysectomized, or adrenalectomized animals and from the action of pure hormones on them.

SUMMARY.

(1) It was found that the addition of samples of human plasma or erythrocyte lysates to aqueous rat brain extracts sometimes greatly affected the rate of the hexokinase reaction. Experiments are described in which these effects were studied in a variety of cases under varying conditions. A series of consecutive blood samples was collected from each subject at regular intervals for a period of several hours, and their effect on hexokinase activity was measured by the rate of glucose disappearance.

(2) In a group of 15 fasting subjects the variation between successive samples from the same individual was small. In this group, and also in an additional group of fasting samples from 77 other subjects, significant activation or inhibition effects were caused by about a third of the plasma samples. In a series of successive samples from fasting subjects there was a significant increase of the plasma effect between the first and second samples, but no significant differences between the second and subsequent samples. The effect is attributed to the early-morning peak of adrenocortical activity.

(3) The effect of mixed meals on the appearance of active factors in plasma was investigated in 15 subjects. The variation between consecutive samples was significantly greater than in the fasting subjects. The frequency of activation but not of inhibition effects was increased.

(4) The effect of an oral glucose test dose on the plasma factors was studied in 48 cases. A significant increase of the individual variation over that observed in fasting subjects was found in the groups of organic disorders, depressions, psychoneuroses and in recently admitted schizophrenics. In the group of chronic schizophrenics, however, the individual variations were significantly smaller and similar to those observed in fasting subjects.

Whereas in cases of psychoneurosis and of recent schizophrenia glucose administration resulted mainly in an increase of activation effects, in the groups of organic disorders and depressions the incidence of inhibition effects

was significantly higher than in the remainder of the series. This is probably connected with the high and sustained rise of blood sugar often found in these cases, since a correlation could be established between inhibition effects and a high blood-sugar rise, and between activation effects and a low blood-sugar rise.

Distinctive monophasic or biphasic reaction patterns could be recognized after oral glucose test doses.

(5) Electric convulsion treatment (12 cases) was followed by changes of plasma effects similar to those observed after glucose test doses. When, however, the blood-sugar rise and the convulsions were suppressed by the administration of pentothal and decamethonium iodide (2 cases), the only effect was the appearance of inhibition effects later than 90 minutes after the shock.

(6) Experiments carried out on 33 patients during insulin shock therapy gave a high mean value for the individual variation of successive plasma effects, although in about one-third of the cases no significant effects were observed during the treatment. Amongst the remainder both activation and inhibition effects occurred with about equal frequency.

(7) The *in vitro* addition of insulin was found to modify the plasma effects significantly. Activation effects were moderately, inhibition effects more strongly depressed, though neither was completely neutralized.

(8) Addition of haemolysate to brain extract usually resulted in a considerable activation of hexokinase activity owing to the presence of a comparatively stable, fixed activator in red blood cells, as previously described (Weil-Malherbe and Bone, 1951b). Superimposed on this effect are fluctuations which in some cases ran parallel to those caused by the addition of plasma. There was, however, no significant statistical correlation between the effects of 364 pairs of observations with plasma and haemolysate prepared from the same blood sample.

(9) When the effects of plasma or haemolysate on brain hexokinase were compared with those on muscle hexokinase a statistical correlation was found, in spite of a considerable scatter. In both cases the linear regression coefficient was close to 1, indicating that the relative sensitivity to activation and inhibition effects was similar in both preparations.

(10) In 10 experiments on 7 diabetic subjects deprived of exogenous insulin an inhibitory effect appeared in plasma in response to a mixed meal. This inhibitory response tended to decline or disappear after the patient had received an injection of insulin. In 7 other diabetic cases no unusual inhibitory effects were found.

(11) The results have been discussed with particular reference to the possible hormonal character of the effects.

ACKNOWLEDGMENTS.

We are greatly indebted to Dr. R. Ström-Olsen, Physician-Superintendent of Runwell Hospital, for his interest and encouragement, and to Dr. R. Sleight Johnson, Southend General Hospital, for his co-operation in obtaining blood specimens from diabetic patients under his care.

REFERENCES.

- ABELIN, I., *Helv. Physiol. Pharmacol. Acta*, 1943, **1**, C81.
 ALTSCHULE, M. D., ALTSCHULE, L. H., and TILLOTSON, K. J., *J. Clin. Endocrinol.*, 1949, **9**, 548.
Idem, ibid., 1949, **9**, 440.
 ANDERSON, E., and LONG, J. A., *Recent Progress in Hormone Research*, 1948, **2**, 209. New York: Academic Press, Inc.
 ASHBY, W. R., *J. Ment. Sci.*, 1949, **95**, 275.
 BORNSTEIN, J., and NELSON, J. F., *Nature, Lond.*, 1948, **162**, 572.
 BOUCKAERT, J. P., and DE DUVE, C., *Physiol. Rev.*, 1947, **27**, 39.
 BROCH-KAHN, R. H., and MIRSKY, I. A., *Science*, 1947, **106**, 148.
 CASTELLUCI, F., *Riv. Sperim. Freniatr.*, 1940, **64**, 523.
 CHRISTENSEN, W. R., PLIMPTON, C. H., and BALL, E. G., *J. Biol. Chem.*, 1949, **180**, 791.
 COLOWICK, S. P., CORI, G. T., and SLEIN, M. W., *ibid.*, 1947, **168**, 583.
 CORI, C. F., *Congress Lecture, First Intern. Congr. Biochem.*, 1950. Cambridge: University Press.
 DURY, A., *Am. J. Physiol.*, 1950, **163**, 96.
 DUTHIE, E. S., and LORENZ, L., *Biochem. J.*, 1949, **44**, 167.
 ELMADJIAN, F., and PINCUS, G., *J. Clin. Endocrinol.*, 1946, **6**, 287.
Idem, FREEMAN, H., and PINCUS, G., *Endocrinology*, 1946, **39**, 293.
 FOGLIA, V. G., and FERNANDEZ, R., *Compt. rend. soc. biol.*, 1936, **121**, 355.
 FORSHAM, P. H., THORN, G. W., PRUNTY, F. T. G., and HILLS, A. G., *J. Clin. Endocrinol.*, 1948, **8**, 15.
 GERSHBERG, H., and LONG, C. N. H., *ibid.*, 1948, **8**, 587.
 GLICK, D., and MOORE, D. H., *Arch. Biochem.*, 1948, **19**, 173.
 GOMORI, G., FRIEDMAN, D. B., and CALDWELL, D. W., *Proc. Soc. Exp. Biol. Med.*, 1939, **41**, 567.
 GROB, D., *J. Gen. Physiol.*, 1943, **26**, 405.
 HEIMAN, M., *Am. J. Psychiat.*, 1941, **98**, 863.
 HOLMGREN, H., and WOHLFARHT S., *Acta Psychiat. Neurol.*, 1944, Supp. 31.
 KAPLAN, N. O., and GREENBERG, D. M., *Am. J. Physiol.*, 1944, **140**, 598.
 KRAHL, M. E., and PARK, C. R., *J. Biol. Chem.*, 1948, **174**, 939.
 LANDSTEINER, K., *Zbl. Bakt. (1 Abt. Orig.)*, 1900, **27**, 357.
 MCFARLAND, R. A., and GOLDSTEIN, H., *Am. J. Psychiat.*, 1939, **96**, 21.
 MEYERHOF, O., and RANDALL, L. O., *Arch. Biochem.*, 1948, **17**, 171.
 MIKKELSEN, W. P., and HUTCHENS, T. T., *Endocrinology*, 1948, **42**, 394.
 NELSON, N., *J. Biol. Chem.*, 1944, **153**, 375.
 PERLMUTTER, M., and GREEP, R. O., *ibid.*, 1948, **174**, 915.
 PIETTE, Y., *Les modifications motrices, respiratoires, cardio-vasculaires et glycémiques au cours de l'électrochoc. Editions Acta Medica Belgica*, 1950. Bruxelles.
 PINCUS, G., *J. Clin. Endocrinol.*, 1943, **3**, 195.
Idem, *Ann. N.Y. Acad. Sc.*, 1949, **50**, 635.
Idem and HOAGLAND, H., *Am. J. Psychiat.*, 1950, **106**, 641, 651.
Idem, FREEMAN, H., and ELMADJIAN, F., *Recent Progress in Hormone Research*, 1949, **4**, 291. New York: Academic Press, Inc.
Idem and ROMANOFF, L. P., *Psychosom. Med.*, 1949, **11**, 74.
Idem, ROMANOFF, L. P., and CARLO, J., *J. Clin. Endocrinol.*, 1948, **8**, 221.
 REID, E., SMITH, R. H., and YOUNG, F. G., *Biochem. J.*, 1949, **42**, xix.
 SAYERS, G., BURNS, T. W., TYLER, F. H., JAGER, B. V., SCHWARTZ, T. B., SMITH, E. L., SAMUELS, L. T., and DAVENPORT, H. W., *J. Clin. Endocrinol.*, 1949, **9**, 593.
 SMITH, R. H., *Biochem. J.*, 1949, **44**, xlii.
 SOMOGYI, M., *J. Biol. Chem.*, 1948, **174**, 597.
Idem, ibid., 1949, **179**, 217.
 STADIE, W. C., and HAUGAARD, N., *ibid.*, 1949, **177**, 311.
Idem and HILLS, A. G., *ibid.*, **184**, 617.
 STEARNS, G., and WARWEG, E., *ibid.*, 1933, **102**, 749.
 TSAI, S. Y., BENNETT, A., MAY, L. G., and GREGORY, R. L., *Proc. Soc. Exp. Biol. Med.*, 1950, **74**, 782.
 VILLEE, C. A., and HASTINGS, A. B., *J. Biol. Chem.*, 1949, **179**, 673.
 WEIL-MALHERBE, H., *Nature, Lond.*, 1950, **165**, 155.
Idem and BONE, A. D., *Biochem. J.*, 1951a, in the press.
Idem, ibid., 1951b, in the press.
Idem, ibid., 1951c, in the press.

GLUTAMIC ACID AND ITS SALTS IN *PETIT MAL* EPILEPSY.

By D. A. POND, M.R.C.P., D.P.M., and M. H. POND, M.A., M.B., B.Chir.

(From the Departments of Clinical Neurophysiology and Biochemistry, The Institute of Psychiatry, Maudsley Hospital, London.)

THE following experiments on glutamic acid were carried out in view of the conflicting reports of Price, Waelsch and Putnam (1943), Waelsch and Price (1944), and Goodman *et al.* (1948) on its effect in epilepsy. A number of preliminary experiments were made which suggested that there was an apparent difference between the effects of glutamic acid and sodium glutamate. Such a difference does not appear to have been considered by most other investigators. It was decided therefore to try to determine whether a possible reason for the difference was the effect of the sodium ion on water balance, since this is known to be related to the tendency to seizures (McQuarrie *et al.*, 1932, Swinyard *et al.*, 1946, and Weinland, 1949). For comparison potassium glutamate was given in a way to be described below. The experiments will be reported under the following headings :

1. The acute E.E.G. and clinical effects of intravenous sodium glutamate.
2. The short term (one week) E.E.G. and clinical effects of glutamic acid, its sodium and potassium salts and a placebo.
3. Longer term clinical effects in out-patients.
4. Biochemical studies of the blood and urine levels of glutamic acid by paper chromatography of 7 epileptic patients and 5 non-epileptic control subjects, including salt and water balance studies of patients and controls.

For all these experiments patients were chosen who had *petit mal* seizures with or without *grand mal* attacks and whose E.E.G. records contained spike and wave activity.

I. THE EFFECTS OF INTRAVENOUS SODIUM GLUTAMATE.

For the intravenous experiments 20 per cent. L (+) glutamic acid was neutralized with sodium hydroxide to exactly pH 7 and sterilized by filtration.

Intravenous sodium glutamate has a number of unpleasant side-effects (cf. Mayer-Gross and Walker, 1949), and it was necessary to prevent the almost immediate vomiting which occurred by a preceding injection of $\frac{1}{100}$ gr. atropine intramuscularly. The effect of atropine itself was tested on a preliminary 10 minute E.E.G. with hyperventilation and then sodium glutamate given. Even when covered with atropine there are a number of unpleasant side effects—a sense of heat and oppression in the chest, thumping in the head and ears and increased pulse-rate which can probably be ascribed to sudden intense autonomic stimulation (cf. Weil-Malherbe, 1950). All these effects passed

off in $\frac{1}{2}$ -1 minute after the injection was stopped, and by slow and frequently interrupted injections about 15-20 ml. could be given in 10 minutes. The number of seconds of the record occupied by spike and wave in 10 minutes was then counted.

Owing to its unpleasant nature the intravenous experiment could be performed only 6 times in 3 subjects. In one subject who showed delta activity as well as spike and wave there was a definite decrease in this slow activity. On four occasions a 10-minute period was obtained after the injection when spike and wave could be counted and the results are shown in Table I. In every case there is a reduction in the amount of epileptic activity.

TABLE I.

	Before I.V. sodium glutamate.		After I.V. sodium glutamate.	
	No. of bursts of S. and W. in 10 minutes.	Total period of S. and W. in 10 minutes.	No. of bursts of S. and W. in 10 minutes.	Total period of S. and W. in 10 minutes.
Subject 1 .	8	39 seconds	1	2 seconds
" 1 .	5	12 "	4	10 "
" 2 .	2	22 "	1	13 "
" 3 .	4	80 "	1	19 "

On the other two occasions hyperventilation was done immediately after the finish of the injection, and it took 12 and 10 seconds respectively more overbreathing than before to produce a burst of spike and wave—a doubtfully significant increase.

2. EFFECTS OF ORAL GLUTAMIC ACID AND ITS SALTS.

In some preliminary experiments of this series reported to the British Branch of the International League against Epilepsy in December, 1949, it was shown that sodium glutamate tended to increase the amount of spike and wave in the E.E.Gs. of *petit mal* patients and to increase the number of clinical attacks. It was shown in one patient that this effect was reversed if the unneutralized glutamic acid was given. In the dosages employed in these experiments (16-24 gm. glutamic acid per day) the neutralized salts represented considerable quantities of sodium ingested. This is well known to tend to produce corresponding water retention, and this in turn is equally well known to increase E.E.G. and clinical epileptic activity.

It was decided therefore to compare the effects of potassium and sodium salts with glutamic acid, as in this way it was hoped to be able to see what part was played by the specific effect of the sodium ion on water and electrolyte balance.

The Latin square shown in Table II was designed to eliminate any effect purely due to the period of hospitalization, and to any "carry-over" effect from one treatment to another. This is possible if it is assumed firstly that the "carry-over" effect from a previous treatment is the same for each patient, and secondly, that treatments other than the immediately previous one do not enter into the "carry-over."

TABLE II.

Weeks.	Patient.			
	1.	2.	3.	4.
1	P	NaGl	KGl	G.A.
2	NaGl	KGl	G.A.	P
3	G.A.	P	NaGl	KGl
4	KGl	G.A.	P	NaGl

G.A. = glutamic acid.

NaGl = sodium glutamate.

KGl = potassium glutamate.

P = placebo.

For this experiment four patients were admitted to the wards who showed frequent spikes and waves in their records. They were kept under steady but not measured conditions of diet, exercise and rest. Two were females, and their ages ranged from 7 to 13 years. During the course of the experiments the patients were taken for E.E.G. every morning, fasting, at approximately the same time after waking on 5 or 6 mornings of each week. A timed 10-minute record was taken in one position on every occasion—a 3-channel bipolar recording with electrodes along the left sides of the head in the anterior-posterior plane. Hyperventilation was done until a clinical attack occurred or a prolonged burst of spike and wave. A capillary blood sugar was done on every occasion and estimated by the method of Hagedorn and Jensen. In each record the following points were noted :

1. The number and duration in seconds of spike and wave bursts occurring during the 10 minutes.
2. The number of seconds of overbreathing before a clinical attack occurred.

In one or two patients the number of spikes and waves occurring in 5 or 10 seconds were counted to see if glutamic acid had any effect on their frequency, but as nothing significant emerged this measure will not be further discussed.

The dose of glutamic acid (neutralized or unneutralized) was either 8 gm. *t.d.s.* or (on some days in connection with water and electrolyte studies) 12 gm. in the morning and 8 gm. in the afternoon, the morning dose always being given one hour before the E.E.G. This time was chosen on the basis of studies of the rate of absorption described below. Breakfast was not given until at least $1\frac{1}{2}$ hours after the dose so as not to interfere with absorption. The placebo was coloured and flavoured water. The potassium and sodium salts are very soluble but had to be flavoured to be tolerable ; the unneutralized acid was given as a sludge in water.

Table III shows the average number of seconds of spike and wave in the standard 10-minute period over each week (5 E.E.Gs.) with a different treatment.

Statistical analysis of the raw daily scores shows that there is a difference at the 1 per cent. level between treatments and between patients, but not between days or weeks (i.e., there is no systematic error simply due to the period of hospitalization or to the method of measuring spike and wave).

TABLE III.—*Seconds of Spike and Wave in the Daily 10-minute Period.*

Week on—	Patient.				Daily mean.	Daily s.d.*
	1.	2.	3.	4.		
Placebo .	12	14	29	52.2	26.80 seconds	25.56
NaGl .	38.4	59.9	53	53.8	51.25 „	21.53
KGl .	32.2	26.4	33.8	84	44.10 „	16.41
G.A. .	13	13.2	15	35.4	19.05 „	19.26

* A test for homogeneity of variance was carried out and the four variances were found to be homogeneous. The best estimate of the s.d. is therefore 22.23.

Analysing the difference between treatments it is shown that there is no significant difference between sodium and potassium glutamate. For both these treatments the number of seconds of spike and wave are significantly higher than the amount of spike and wave during the placebo period. Although the amount of spike and wave under the glutamic acid treatment was the lowest of all four treatments, the difference from the placebo is not significant. However, glutamic acid and the placebo would differ significantly at the 1 per cent. level of significance if the same difference (i.e., 7.75 seconds) were obtained in a group of 20 patients.

In four other patients not included in this Latin square but tested under the same conditions, there was a similar non-significant decrease in the amount of spike and wave with glutamic acid and an increase on the salts.

Table IV shows the average number of seconds of overbreathing required to produce a clinical attack. There were no significant differences between treatments, patients, days or weeks.

TABLE IV.—*Seconds of Overbreathing to Clinical Attack.*

On—	Patient.				Daily mean.	Daily s.d.*
	1.	2.	3.	4.		
Placebo .	41	42	28	19	32.65 seconds	24.77
NaGl .	12.4	49	35	33	32.65 „	20.18
KGl .	28	53	42	27	37.50 „	37.54
G.A. .	44	30.4	45	26	36.35 „	21.39

* The test for homogeneity of variance found a difference significant at the 5 per cent. level but not at the 1 per cent. level ($L_1 = .878$).

The blood-sugar values varied between 80 and 100 mgm. per cent. on practically every occasion. The average value during the placebo weeks was 85 mgm. per cent. and during the other weeks was 87 mgm. per cent., so that there was no correlation between the average values in any one week and the amount of spike and wave or the overbreathing time, a hardly surprising result in view of the comparatively small blood-sugar range.

That the E.E.G. effects are probably cumulative at least over the 24 hours was suggested by the results in one patient who had E.E.Gs. done under the standard conditions, but who did not receive the morning glutamic acid dose until after the E.E.G. There was approximately the same decrease in spike and wave as in the patients tested one hour after the glutamic acid dose.

There did not appear to be any other significant change produced in the E.E.G. other than the reduction in spike and wave. Occasionally there appeared to be less slow activity such as might have been expected from the intravenous experiments.

As a further check on the acute effects of glutamic acid an attempt was made to remove the substance from the body. Ambrose, Power and Sherwin (1933) showed that phenyl-acetic acid is excreted in conjunction with the amide of glutamic acid, and that in this way the body can be made to excrete large quantities of the latter. A partially neutralized solution of about 7 gm. of phenyl-acetic acid to the fluid ounce was therefore administered suspended in mucilage and water and suitably flavoured to be palatable. It was given to one subject three times a day for a week without there being any change in the number of clinical attacks or the amount of epileptic activity in her E.E.G. on the usual daily recordings.

3. LONGER TERM CLINICAL EFFECTS.

The in-patient experiments were too short to allow the observation of any possible long-term effects such as has been claimed by Zimmerman (1947) and others in mental defect. A longer trial of the clinical effects in out-patients was therefore undertaken. In the preliminary investigations, when sodium glutamate only was used, no improvement at all was obtained in any of ten patients who were given 8 gm. *t.d.s.* for a month. In fact in two patients who had *grand mal* as well as *petit mal* attacks the former were actually increased.

A total of 8 patients (other than those partaking in the in-patient investigations) have now had glutamic acid for periods of one to four months. They are all children or young adults, and included two who had previously had sodium glutamate. The dose given was usually 24 gm. per day, given in divided doses. Of the eight, five reported a decrease in the number of seizures but the effect tended to wear off after a few weeks. Two of the patients not improved suffered also from occasional *grand mal* seizures, which were actually increased in number in both.

There was spontaneous comment of improved behaviour by the parents of two of the children who had fewer fits.

The effects were in some ways comparable to that of amphetamine, but in two cases in whom this drug was given for a time simultaneously with the glutamic acid there was no evidence of any synergistic action, such as was suggested by Weil-Malherbe (1950). In no case was the improvement as dramatic as that normally obtained by tridione, and for this reason the experiments have not been continued.

4. BIOCHEMICAL INVESTIGATIONS.

The first aim of the biochemical investigations was to study the absorption and excretion of the glutamic acid and its salts. No accurate chemical or microbiological method for estimating glutamic acid was readily applicable to our patients, but paper chromatographic studies of urine and plasma amino-

acids were being carried out for other experiments, and this method was found to give useful data about the rate of absorption and excretion of glutamic acid, including a rough quantitative estimation of the actual amounts involved. The technique of two-way paper chromatograms using phenol and collidine as solvents follows in principle the methods of Consden, Gordon and Martin (1944 and 1947) and Dent (1948). The exact details of the method including both the experimental work and the quantitative assessment of results used by one of us are described elsewhere (Pond, 1950). It will be sufficient to say here that paper chromatograms carried out in duplicate on each specimen of desalted urine and plasma ultrafiltrate gave reliable and consistent results as regards the presence or absence of glutamic acid and glutamine and other normal amino-acid constituents of body fluids. It was also easy to detect large variations in concentration from the normal range, but we do not place much reliance on small quantitative variations, knowing that the error of quantitative assessment of results is about ± 30 per cent.

CLINICAL MATERIAL.

Twelve cases were studied. Seven were in-patients forming a part of the series described above. Five were non-epileptic volunteer controls. All patients received urine investigation, but it was only possible to carry out plasma investigations on 4 patients and 2 controls. All investigations on in-patients were carried out on at least two or three different days during the week's investigation on each drug. Of the controls, only 2 were in-patients and investigated in exactly the same way, the out-patients being investigated on one occasion only. All the in-patients received glutamic acid, the sodium and potassium salts, but the 3 out-patient controls received sodium glutamate and glutamic acid only.

The specimens were collected at the following times: Urine was collected fasting and then 1, 2, 4, 6 and 8 hours after administration of the drug. Plasma was collected fasting and then $\frac{1}{2}$, 1, 2, 4 and 6 hours after administration. It was not always possible to collect a complete series of plasma specimens on the same day owing to the difficulty of repeated venepuncture on children. All drugs were given orally on an empty stomach morning and evening, meals being then withheld for $1\frac{1}{2}$ hours to prevent interference with absorption.

RESULTS.

No difference of any kind was found between normal controls and epileptic patients and therefore their results are treated together.

Table V represents a specimen series of results, and the range and average values where sufficient results are available, of plasma ultrafiltrate levels following the oral ingestion of the three drugs.

Each of the three drugs when examined by this method appear as glutamic acid in the final picture, the sodium and potassium ions being removed in the desalting process. Hence they are easily comparable, and it is the comparison of the three series of results which is of the greatest value. No great accuracy

TABLE V.—*Plasma Ultrafiltrate Levels (mgm./100 ml.) of Glutamic Acid after the Ingestion of the Acid, Sodium Glutamate and Potassium Glutamate.*

Time.	Drug given.								
	Glutamic acid.			Sodium glutamate.			Potassium glutamate.		
	Specimen series.	Range.	Average.	Specimen series.	Range.	Average.	Specimen series.	Range.	Average.
Fasting .	1	1-3	2	2	1-3	2	1	Insufficient results	
$\frac{1}{2}$ hour .	1	1	1	8	6-8	7	6	"	"
1 " .	4	3-6	3	20	6-20	12	20	"	"
2 hours .	10	1-11	6	22	4-22	12	11	"	"
4 " .	4	3-4	4	3	2-3	3	1	"	"
6 " .	3	—	—	1	1	1	1	"	"

is claimed for the actual figures, and there are wide variations in day-to-day values for similar experiments. This may be compared with reports by other workers—Prescott and Waelsch (1947), and Krebs, Eggleston and Hems (1949)—that glutamic acid values in plasma vary considerably from day to day and patient to patient, even when estimated by more accurate chemical methods. However, the following broad trends appeared: Firstly, the maximum blood levels occurred between 1 and 2 hours after the administration of sodium and potassium salts, a return to normal being complete in 4 hours. The response to glutamic acid administration tended to be less marked and to be spaced over a longer period, that is, between 1 and 4 hours after dosage.

The excretion of glutamic acid in the urine following administration of the drug followed a very standard pattern. Fasting urines showed occasional traces of glutamic acid and this was taken as normal (equivalent to not more than 20 μ gm./ml.). Following the ingestion of glutamic acid there was occasionally a small rise in the excretion of glutamic acid, but more commonly there was no excretion of glutamic acid. The excretion of glutamic acid, if present, amounted to less than 30 mgm. in 8 hours following the dose (i.e. less than 0.05 per cent. of the dose given). However, sodium and potassium salts behaved quite differently from glutamic acid, though similarly to each other. In every case the quantities excreted in the first few hours after the dose were large compared with those after glutamic acid. The excretion on different days was variable, being approximately 0.25 to 0.75 gm., i.e., about 3 per cent. of the total dose given. The maximum excretion was always in the first two hours, excretion being complete in 6 hours. Table VI shows a series of typical results in which each urine has been examined in the chromatogram in an amount proportional to its specific gravity, therefore eliminating any changes in concentration due to the varying dilution of the urine.

In all investigations on both plasma ultrafiltrate and urine the other amino-acids were normal in pattern and concentration. Slight alterations of glutamine were sometimes observed, but they were considered too small to be of any significance. The possibility was considered that glutamine was easily "lost" during the experiment by acid hydrolysis, causing a relative increase of glutamic acid. By controlled experiments using known quantities of the pure substances, it was found that only a small loss (less than 10 per cent.)

TABLE VI.—*Specimen Urinary Levels of Glutamic Acid after Ingestion of Glutamic Acid and Sodium and Potassium Salts. (Quantities examined proportionate to s.g. of urine specimen.)*

Time.	Drug given.		
	Glutamic acid.	Sodium glutamate.	Potassium glutamate.
Fasting	—	—	—
1 hour	+	++++	} +++++
2 hours	tr.	+++	
4 "	—	+	+
6 "	—	tr.	—
8 "	tr.	—	—

— = no glutamic acid detected.
 tr. = light "spots" equivalent to less than 2 mgm.
 + } = light "spots" equivalent to 3-10 mgm.
 ++ } = medium "spots" equivalent to 10-40 mgm.
 +++ } = medium "spots" equivalent to 40-80 mgm.
 ++++ } = heavy "spots" equivalent to over 80 mgm.

(Quantities examined were usually 25-100.)

occurred in this way if reasonable cooling precautions were taken during the desalting.

All other amino-acids were always normal with the occasional exception of aspartic acid. The normal fasting value of aspartic acid in the blood was found to be 0-1 mgm./100ml. Whenever the value of glutamic acid reached more than about 10 mgm./100 ml. of plasma ultrafiltrate, there was a corresponding rise of aspartic acid up to about 2 mgm./100 ml. The same was true of the urine: whenever there was a large excretion of the one (+++ or ++++) there was a relative increase in the excretion of the other.

In view of these findings the question of contamination of the glutamic acid used by aspartic acid was investigated by running chromatograms on ethanol solutions of the original substance. However, no aspartic acid was found, and therefore any rise demonstrated in the patients was due to an *in vivo* reaction.

It is to be noted that in common with all other investigators we have considered only the free glutamic acid in the urine. It is generally assumed that no significant variations occurred in the combined glutamic acid.

WATER-ELECTROLYTE STUDIES.

Measurements were taken on 7 patients of—

1. Daily weight.
2. Twenty-four-hour intake of fluid and output of urine.
3. The urinary chlorides on the twenty-four specimens and specimens passed 2, 4 and 6 hours after dosage three times each week.

For various reasons a full study proved an impossible aim and the records are very incomplete. Such measurements as were obtained were disappointing in that few conclusions can be drawn. The twenty-four-hour volumes and chloride content showed no significant variations during the whole experiment. Neither did daily weight charts suggest any water retention during sodium glutamate therapy, except in one patient who gained three pounds during the

week on sodium glutamate, followed by a return to her previous weight the next week.

Furthermore, the fact that sodium and potassium glutamate had such similar E.E.G. effects, though the body deals with these two ions quite differently, suggests that it is doubtful whether the sodium ion and water retention could have played a significant part in the action of sodium glutamate in contrast to glutamic acid.

Chloride estimations of urine specimens passed for the first six hours after the drug showed suggestive changes in about half the cases investigated, the other half showing no change at all. The results in two patients summarized in Table VII below show a large increase in chloride excretion following potas-

TABLE VII.—*Average Values of Three Estimations of Urinary Chlorides Excreted in 6 hours Following Glutamic Acid and its Salts (Volhard's Method).*

		Drug given.		
		Sodium glutamate.	Potassium glutamate.	Glutamic acid.
Patient 1	.	2.14 gm.Cl.	6.9 gm.Cl.	4.5 gm.Cl.
Patient 2	.	2.55 „	6.9 „	4.2 „

sium glutamate and a decrease following sodium glutamate as compared with glutamic acid. This suggests chloride retention following the sodium salt and chloride excretion following the potassium salt, but the results were not borne out in all patients. Accurate determination could not be carried out, as strict dietary control could not be instituted, and it was necessary to assume that an average value of three days' estimation would rule out some of the variation of salt content in a standard hospital diet.

In two other patients alkali reserve and plasma chlorides were taken between one and two hours after each drug without any significant changes being detected.

DISCUSSION.

There appears to be some fairly definite evidence that glutamic acid can decrease the amount of spike and wave and the number of attacks in patients with *petit mal*. However, the effect is slight and probably only transitory. As a therapeutic measure it can hardly be considered worth while, and for this reason no further experiments were undertaken in an effort to elucidate its mechanism of action.

Some of our experiments were designed to investigate the apparently simpler problem of the difference between glutamic acid and its salts. The factor of deficient absorption in the cases of the salts may be considered ruled out by the high blood and urine levels obtained after these salts. In fact, the salts appear to be absorbed more quickly and completely than the acid itself, probably due simply to their solubility. Other possible reasons for the difference are that the acid is in some way more quickly and easily metabolized in the tissues, thus accounting for the lower blood and urine levels than appear with the salts; or, the beneficial effect of the glutamic acid is counteracted by

the absorption at the same time of large quantities of sodium and potassium (2.4 and 3.9 gm. respectively per 20 gm. salt). The former seems doubtful on the present insufficient evidence, and the latter was not borne out by any salt-and-water balance studies carried out. The greater excretion of glutamic acid after the salts, although twenty times greater than that of the glutamic acid after the unneutralized acid, is still negligible in explaining the failure of the salts to produce a comparable effect, since it amounts to only 3 per cent. of the total dose given and is probably a simple overflow mechanism. Hence no explanation of the differences between glutamic acid and its salts can be satisfactorily given, although the fact that this difference exists has been undeniably shown.

The many possible modes of action of glutamic acid in the metabolism of the brain have been recently reviewed by Waelsch (1948) and Weil-Malherbe (1950). From the experiments of the latter on the effects of glutamic acid in hypoglycaemic coma, it is possible that the positive effects of glutamic acid may be equally non-specific in *petit mal* epilepsy. It is even by no means certain that the site of action is in the brain, since its concentration there does not increase following intravenous injection of glutamic acid (Klein and Olsen, 1947), though Waelsch (1949) finds the brain glutamine level does rise. It certainly does not appear to depend on the plasma level, as this returns to normal in 6-8 hours and the positive effect seems to last up to 24 hours.

Nor is there evidence that there are significant variations in the other amino-acid levels in the plasma, such as, for example, Waelsch (1949) reports in the glutamine and glutamic acid ratio. The small changes in aspartic acid levels with very high blood and urine glutamic values are consistent with the findings of Cohen (1940) and Awapara and Marvin (1949), and the postulated reaction involving glutamic aspartic transaminase, converting glutamic to aspartic acid via oxaloacetic and α -ketoglutaric acids.

The marked, predominantly sympathetic, autonomic reaction produced by the intravenous injection is in line with Weil-Malherbe's suggestion that glutamic acid acts as a relatively non-specific adrenergic agent. However, no similar effects were seen with oral dosage. Our data threw no light on the various other possibilities such as changes in the permeability of neuronal membranes to potassium (Krebs and Eggleston, 1949).

SUMMARY.

The clinical and electroencephalographic effects of glutamic acid and its sodium and potassium salts in a total of 16 epileptics were investigated. The sodium salt was given intravenously in a few experiments, and orally in longer experiments in comparison with the acid and potassium salt. It was shown that the salts given orally significantly increased the amount of epileptic activity in the E.E.G. and the acid produced a decrease, but not at a statistically significant level. No consistent clinical changes were demonstrated, although 5 out of 8 patients given glutamic acid over a month reported a temporary decrease in the number of seizures. Biochemical investigations on some of the epileptics and a comparable number of controls (blood and urine

glutamic acid levels by chromatography and other studies) failed to demonstrate any obvious mechanism for these differences. However, differences in the rates of absorption and between the acid and salts were demonstrated and discussed.

We have to thank Dr. Magee of the Ministry of Health for a supply of glutamic acid through Professor Aubrey Lewis; Miss Joan D. May of the Department of Statistics for the Latin Square and other statistical assistance; Dr. H. McIlwain of the Department of Biochemistry for much help and advice throughout; Dr. Denis Kennedy of Lingfield Epileptic Colony for access to some of the children under his care; and Mr. P. Chappell of the Department of Clinical Pathology for doing certain biochemical determinations.

REFERENCES.

- AMBROSE, A. M., POWER, F. W., and SHERWIN, C. P., *J. Biol. Chem.*, 1933, **101**, 669-675.
AWAPARA, J., and MARVIN, H. N., *ibid.*, 1949, **178**, 691-693.
COHEN, P. P., *ibid.*, 1940, **136**, 565-584.
CONSDEN, R., GORDON, A. H., and MARTIN, A. J. P., *Biochem. J.*, 1944, **38**, 224-232.
Idem, *ibid.*, 1947, **41**, 590-596.
DENT, C. E., *ibid.*, 1948, **43**, 169-180.
GOODMAN, L. S., SWINYARD, E. A., and TOMAN, J. E. P., *Arch. Neur. Psych.*, 1946, **56**, 20-29.
KLEIN, J. R., and OLSEN, N. S., *J. Biol. Chem.*, 1947, **167**, 1-5.
KREBS, H. A., and EGGLESTON, L. V., *Biochem. J.*, 1949, **44**, vii.
Idem and HEMS, R., *ibid.*, 1949, **44**, 159-163.
MAYER-GROSS, W., and WALKER, J. W., *ibid.*, 1949, **44**, 92-97.
MCQUARRIE, I., HUSTED, C., and MANCHESTER, R. C., *Am. J. Dis. Child.*, 1932, **43**, 1519-1543.
POND, M. H., *J. ment. Sci.*, 1950, **96**, 1048-1054.
PRESCOTT, B. A., and WAELSCH, H., *J. Biol. Chem.*, 1947, **167**, 855-860.
PRICE, J. C., WAELSCH, H., and PUTNAM, T. J., *J.A.M.A.*, 1943, **122**, 1153-1156.
SWINYARD, E. A., TOMAN, J. E. P., and GOODMAN, L. S., *J. Neurophysiol.*, 1946, **9**, 47-54.
WAELSCH, H., and PRICE, J. C., *Arch. Neur. Psychiat.*, 1944, **51**, 393-396.
Idem, *Am. J. Ment. Def.*, 1948, **52**, 305-313.
Idem, *Lancet*, 1949, ii, 1-5.
WEIL-MALHERBE, H., *Physiol. Rev.*, 1950, **30**, 549-568.
WEINLAND, W. L., *Arch. Psychiat. Nervenkrankh.*, 1949, **183**, 402-417.

GLUTAMIC ACID AND GLUCOSE AS SUBSTRATES FOR MAMMALIAN BRAIN.

By H. McILWAIN, D.Sc., Ph.D.,

Reader in Biochemistry, Biochemical Laboratories, Institute of Psychiatry,
Maudsley Hospital, S.E.5.

EFFECTS of substances on the respiration of unstimulated portions of mammalian brain have been used in the past as aids to understanding or suggesting their actions on the brain *in vivo*. The present paper gives data with respect to glucose and glutamic acid, which show some of the limitations of such interpretations. It also describes the application of new experimental means of examining the metabolic effects of added substances in relation to the functional activity of the brain.

A link between respiration and functioning of tissues of the central nervous system exists in the phosphorylation which normally accompanies respiration, and which maintains the energy-rich compounds which are utilized in supporting activities of the brain. Methods have been devised in these laboratories by means of which both the maintenance of these compounds and the response of the tissue to electrical stimulation can for the first time be studied *in vitro* (McIlwain, 1951*a*; McIlwain, Buchel and Cheshire, 1951). We have therefore applied them in the present investigation to glutamic acid, as the effects of this substance on the central nervous system have been complicated by its effects on other systems of the body. During recent years its administration has been reported to affect a number of aspects of behaviour or of mental phenomena in experimental animals and in man (for assessment of these reports, see Weil-Malherbe, 1950; Milliken and Standen, 1951). As one of the bases for such effects, the ability of glutamic acid to support the respiration of separated portions of mammalian brain has been quoted (see, for example, Gadson, 1951). We now find, however, that glutamic acid does not maintain the energy-rich compounds of the tissue, nor does it enable the tissue to respond to electrical stimulation *in vitro* as does glucose.

EXPERIMENTAL.

Tissues (mainly cerebral cortex) from guinea-pigs and rats were used, prepared as described elsewhere (McIlwain, 1951*a, b*; McIlwain, Buchel and Cheshire, 1951), where descriptions of experimental salines are also given. Respiration was measured manometrically, and glycolysis by chemical determination of lactic acid. Inorganic phosphate and phosphocreatine were determined in the tissues after extraction with trichloroacetic acid; this and the conditions of electrical stimulation of the separated tissues are described in the papers quoted. L(+) glutamic acid, taken to pH 7.3 by NaOH, was used.

RESULTS.

Respiration.—The present experiments were carried out with cerebral cortex, in saline solutions buffered at pH 7.3 either with phosphate or with glycylglycine. In all cases respiration with glutamate as substrate was initially higher than with glucose as substrate. The initial part of Fig. 1 and values of

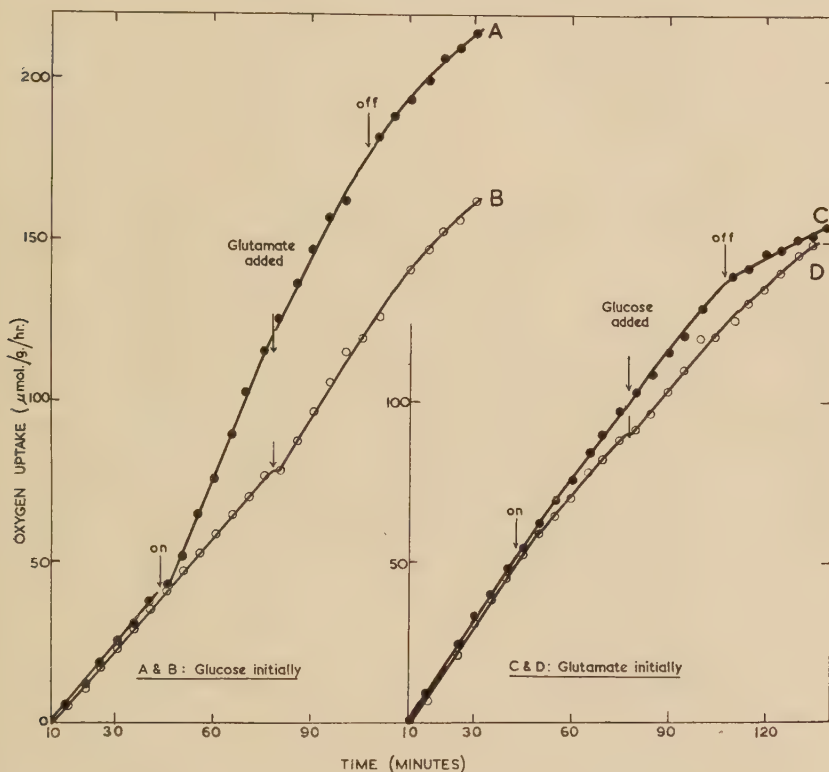


FIG. 1.—Respiration of fragments of rat cerebral cortex in phosphate-saline with glucose and glutamate as substrate, with and without electrical stimulation (condenser pulses of peak voltage 25, time-constant 0.4 msec., 100/sec). A and B: with glucose initially and glutamate added at 78 min. C and D: with glutamate initially and glucose added at 78 min. A and C were stimulated electrically between 44 and 108 min.

Tables I and II illustrate this; in some 16 experiments the rate during the first hour with glutamate was about 125 per cent. of that with glucose. Similar results have been found previously with tissues from various species and in various media (Krebs, 1935; Weil-Malherbe, 1936).

In the course of two or three hours respiration with the two substrates became approximately equal. Respiration with a mixture of both substrates was usually slightly higher still, but again fell with time. A marked effect of adding glutamate to tissue respiring in glucose is shown in Fig. 1, B.

Phosphates.—Certain phosphorus derivatives in the brain of intact animals show large and rapid changes with changes in the state of activity of the central nervous system. Prominent among these derivatives are inorganic phosphate

TABLE I.—*Phosphates of Cerebral Cortex Slices Respiring with Glucose and Glutamate as Substrates.*

Species.	Substrate.	Respiration (μ mol. O ₂ /gm./hr.).	Inorganic phosphate (μ mol./gm.).	Creatine phosphate (μ mol./gm.).
Rat . . .	Glucose .	91 .	3.45 .	1.14
„ . . .	„ .	93 .	3.4 .	1.10
Rat . . .	Glutamate .	105 .	4.6 .	0.31
„ . . .	„ .	110 .	5.05 .	0.26
Guinea-pig .	Glucose .	66 .	2.95 .	1.16
„ . . .	„ .	61 .	3.2 .	1.12
Guinea-pig .	Glutamate .	75 .	4.4 .	0.29
„ . . .	„ .	79 .	5.0 .	0.33

Slices were in glycylglycine-buffered salines (1 ml./20 mgm. slice), and were extracted after respiration at 37° on O₂ for 40 min. Substrates, 0.015 M, were present throughout.

and phosphocreatine (for references see McIlwain, 1950; Richter, 1951). Phosphocreatine falls and inorganic phosphate rises with increased central activity. During the preparation of slices for metabolic experiments the concentrations of these substances in the tissue change greatly; creatine phosphate falls to some 0.3 μ mol./gm. and inorganic phosphate rises to some 6 μ mol./gm. Metabolism with glucose as substrate partly restores these substances to their levels in the normal tissues (McIlwain, Buchel and Cheshire, 1951). Examples are shown in Table I in which creatine phosphate has been raised to 1.1–1.2 μ mol./gm. and inorganic phosphate lowered to 2.9–3.4 μ mol./gm. by respiration with glucose as substrate. Glucose has thus restored the tissue to a condition in which it can respond to stimulation (see below).

Respiration with glutamate as substrate did not have this effect. Creatine phosphate remained at the low level of some 0.3 μ mol./gm. found in the absence of substrate or of oxygen. Also, inorganic phosphate was not lowered to the same extent as in the presence of glucose. Glutamate, moreover, lowered the creatine phosphate and increased inorganic phosphate when added to tissues already respiring in glucose. The concentration of glutamates in these experiments were ample for high rates of respiration and were typical of those used by previous workers. Lesser concentrations of glutamate and also glutamine had lesser effects on the phosphates (unpublished).

Response to electrical stimulation.—Isolated portions of tissue from the central nervous system, respiring in glucose, were found to respond to suitable electrical impulses by large increases in respiration and glycolysis (McIlwain, Anguiano and Cheshire, 1951). The respiration which took place in the absence of added substrate was not increased by electrical stimulation. The increase with glucose is illustrated by some of the results of Fig. 1 and Table II. Fig. 1 shows the course of respiration of fragments of rat cerebral cortex; A and B are similar until at 44 min. electrical pulses are applied to A, when its rate of respiration doubles. In Fig. 1 the slopes of the lines give rates of respiration, and such rates are recorded in Table II. This table shows the increase in respiration following a variety of different types of impulses.

TABLE II.—*Effects of Electrical Changes on Respiration with Glutamate and Glucose.*

Electrical arrangements.		Tissue.	Substrates (M).	Respiration in successive periods (μ mol. O ₂ /gm./hr.).	
Vessel and electrodes (see McIlwain, 1951a and b).	Impulse and voltage (a.c.: alternating current; C: condenser pulses).			Unstimulated.	Unstimulated.
A, A	a.c.; 2.5 V.	Slice, fixed	Glucose	63	98
A, A	a.c.; 2 V., 3 V.	"	Glutamate	77	70
A', C	a.c.; 2.5 V.	"	"	75	72
A', F	a.c.; 2.5 V.	"	"	68	70
E	C; 24 V. (0.5 μ sec.).	Slice, fragments	Glucose	64	110
E	C; 24 V. (0.5 μ sec.).	"	Glutamate	68	63
E	C; 24 V. (0.5 μ sec.).	"	Glucose and glutamate	68	59
E	C; 24 V. (0.1 μ sec.).	Slice, fragments	Glucose	63	93
E	C; 24 V. (0.1 μ sec.).	"	Glutamate	69	67
E	C; 24 V. (0.1 μ sec.).	"	Glucose and glutamate	72	70

Slices of guinea-pig cerebral cortex in phosphate-buffered glucose salines (approx. 1 ml./20 mgm. slice) were shaken in O₂ at 37°. The periods were of 40 min. each, commencing about 30 min. after death of the animal. The electrical charges applied were alternating current (a.c.) at 50 cyc./sec. or condenser pulses (C), of which there is quoted the peak voltage, and time taken to fall to one-third of the peak voltage. Substrate present throughout were all at 0.015 M. Slice fragments had a mean weight of about 2 mgm.

Impulses which were effective with glucose as substrate had, however, little or no effect when glutamate was used as substrate. Thus in Fig. 1 lines c and d diverge only a little during the application of impulses to c, between 44 and 78 min. There was also little or no response with the variety of impulses of Table II. These included changes of between 2 and 24 V., lasting 0.1 to 20 msec., and frequencies of 50 or 100 sec. For choice of these values see McIlwain (1951a). Any effect of stimulation in the presence of glutamate appeared to be to delay the fall in respiration which normally occurred during experiments with glutamate as substrate. When the current was switched off respiration in most cases fell.

Impulses applied to tissue metabolizing in the presence of both glucose and glutamate were also ineffective, or nearly so (Table II). Similar results were given when the order of adding the substrates or applying the current were varied. Thus, addition of glutamate to tissue which was already responding to stimulation by any increase in respiration caused, if anything, a small fall in respiration (Fig. 1, A). This was in marked contrast to the effect of adding glutamate to unstimulated tissue respiring in glucose, when respiration increased (Fig. 1, B). Again, when glucose was added to a slice which was respiring in glutamate and to which impulses were being applied, any increase in respiration was very small (Fig. 1, c). The impulses were, however, maintaining the respiration to some extent, as it fell when the impulses were stopped.

DISCUSSION.

Although glutamic acid has supported the respiration of cerebral tissues, it has not otherwise reacted as might be expected of a substance supporting the activity of the brain. It has not increased, but has decreased, the tissue-content of the energy-rich creatine phosphate. It has not enabled the tissue to respond metabolically to electrical stimulation, but has prevented response in preparations otherwise capable of doing so. Of these findings, the increased respiration has been known previously. It has been suggested that this increase was related to improved behaviour or mental functioning following administration of glutamic acid to rats, to defective children, or to subjects in hypoglycaemic coma. Our other findings might, on similar grounds, lead to opposite expectations. The reasoning, however, is tenuous. Weil-Malherbe (1950) has concluded that certain of these actions may be secondary to the release of adrenalin which glutamic acid brings about in intact animals.

The present findings may, however, offer a basis for the anticonvulsive actions of glutamic acid. Though these actions are surpassed by those of synthetic anti-convulsive drugs, glutamic acid reduces the number of *petit mal* seizures in a proportion of individuals (Price, Waelsch and Putnam, 1943; see Pond and Pond, 1951). The reduction in electrical excitability of the tissue which we observe gives an immediate basis for anticonvulsive action. Feeding extra glutamic acid is reported not to affect electroshock seizures in various experimental animals (Toman, Swinyard and Goodman, 1946), but to raise the threshold to electroshock in pyridoxine-deficient rats (Davenport and Davenport, 1948). Intravenously administered glutamic acid possibly reaches

the cerebral tissues of mice (Waelsch, 1949; Schwerin, Bessman and Waelsch, 1950), but this has not been demonstrated in the rat following intravenous (Friedberg and Greenberg, 1947), oral or parenteral (Tigerman and MacVicar 1951) administration. Variable access to the tissue may explain the variable findings in man. Here orally administered glutamic acid is known to reach the blood stream (Bessman, Magnes, Schwerin and Waelsch, 1948; Pond and Pond, 1951), but has not been determined in the brain itself.

Independently of such interpretations, the present findings show an excellent correlation between the tissue level of creatine phosphate (which is known to support the activity of the brain *in vivo*) and the ability of the tissue to respond to electrical stimulation. It is especially noteworthy that glutamic acid lowers the creatine phosphate of tissues already respiring with glucose, and greatly reduces their excitability.

The present findings do not mean that glutamic acid or its amide glutamine are unimportant in nervous tissues, but only that under the conditions employed in the experiments the substances cannot be supposed to be major energy-yielding fuels. This is, however, a significant limitation. The conditions include those under which glutamic acid increases the respiration of cerebral tissues. Moreover, there are indications that glutamic acid and glutamine do not serve as major energy-yielding substrates for the brain *in vivo*. The oxygen uptake of the brain determined *in vivo* by arterial-venous difference is nearly equivalent to the glucose oxidized (Himwich and Himwich, 1946), though glutamic acid and glutamine are also available in the blood stream and in the brain. The glutamic acid content of the brain of insulin-hypoglycaemic rats is lower than normal (Dawson, 1949), but general blood-amino-acid levels are also lower. If the lower level in the brain implies usage by the brain, insulin coma shows that the usage is not adequate for maintaining normal cerebral activities. Mayer-Gross and Walker's (1949) experiments are also consistent with this view in indicating that any action of administered glutamic acid in insulin hypoglycaemia, apart from that secondary to change in blood glucose, is a relatively small one, and is shared by substances which do not act as energy-yielding substrates in the brain. In these experiments, contributions to the effects of glutamic acid which were not due to changes in blood glucose may have been made by other changed blood constituents such as pyruvic and α -ketoglutaric acids (cf. Villano and Rota, 1947).

SUMMARY.

1. Glutamic acid, unlike glucose, does not maintain the creatine phosphate of separated portions of mammalian cerebral cortex.

2. Cerebral tissues respiring with glutamic acid as substrate give little or no response to electrical stimulation. Response is given with glucose as substrate, but not with a mixture of glutamic acid and glucose.

3. Respiratory findings with cerebral tissues and glutamic acid therefore do not necessarily imply that it can act as an energy-yielding substrate for the brain. The present results may be related to the small degree of anti-convulsant activity shown by glutamic acid.

I am greatly indebted to Mr. P. J. W. Ayres and Miss S. Russell for assistance during this investigation.

REFERENCES.

- BESSMAN, S. P., MAGNES, J., SCHWERIN, P., and WAELSCH, H., *J. Biol. Chem.*, 1948, **175**, 817.
DAVENPORT, V. D., and DAVENPORT, H. W., *J. Nutrit.*, 1948, **36**, 263.
DAWSON, R. M. C., *Nature*, 1949, **164**, 1097.
FRIEDBERG, F., and GREENBERG, D. M., *J. Biol. Chem.*, 1947, **168**, 411.
GADSON, E. J., *Amer. J. Ment. Defic.*, 1951, **55**, 521.
HIMWICH, W. A., and HIMWICH, H. E., *J. Neurophysiol.*, 1946, **9**, 133.
KREBS, H. A., *Biochem. J.*, 1935, **29**, 1620.
MCILWAIN, H., *Brit. Med. Bull.*, 1950, **6**, 301.
Idem, *Biochem. J.*, 1951a, **49**, 382.
Idem, *ibid.*, 1951b, in press.
Idem, ANGUIANO, G., and CHESHIRE, J. D., *ibid.*, 1951, in press.
Idem, BUCHEL, L., and CHESHIRE, J. D., *ibid.*, 1951, **48**, 12.
MAYER-GROSS, W., and WALKER, J. W., *ibid.*, 1949, **44**, 92.
MILLIKEN, J. R., and STANDEN, J. L., *J. Neurol. Neurosurg. Psychiat.*, 1951, **14**, 47.
POND, D. A., and POND, M. H., *J. Ment. Sci.*, 1951, **97**,
PRICE, C. J., WAELSCH, H., and PUTNAM, T. J., *J. Amer. Med. Ass.*, 1943, **122**, 1153.
RICHTER, D., *Recent Progress in Psychiatry*. 2nd ed. 1951, 26.
SCHWERIN, P., BESSMAN, S. P., and WAELSCH, H., *J. Biol. Chem.*, 1950, **184**, 37.
TIGERMAN, H., and MACVICAR, R., *ibid.*, 1951, **189**, 793.
TOMAN, J. E. P., SWINYARD, E. A., and GOODMAN, L. S., *J. Neurophysiol.*, 1946, **9**, 321.
VILLANO, F., and ROTA, L., *Bull. soc. ital. biol. sper.*, 1947, **23**, 254.
WAELSCH, H., *Lancet*, 1949, ii, 1.
WEIL-MALHERBE, H., *Biochem. J.*, 1936, **30**, 665.
Idem, *Physiol. Rev.*, 1950, **30**, 549.

AN EVALUATION OF THE RORSCHACH TEST AS A PROGNOSTIC AID IN THE TREATMENT OF SCHIZOPHRENIA BY INSULIN COMA THERAPY, ELECTRONARCOSIS, ELECTROCONVULSIVE THERAPY AND LEUCOTOMY.

By W. LINFORD REES, M.D., B.Sc., M.R.C.P., D.P.M.,
Regional Adviser in Psychiatry for Wales and Monmouthshire,

and

A. M. JONES, B.A., B.Ed.,
Psychologist, Whitchurch Hospital.

THE possibility of using the Rorschach test to predict outcome of insulin coma treatment of schizophrenia has been investigated by Piotrowski (1938, 1939 and 1941).

In a preliminary study Piotrowski (1938) found that schizophrenics who improved with insulin therapy differed from unimproved patients in pre-treatment Rorschach records in a number of respects. The improved group showed in their responses to the Rorschach ink blots evidence of a greater degree of emotional responsivity, excitability and lability than unimproved patients, indicative of a closer emotional contact with the environment.

Piotrowski (1940) attempted to determine with greater precision the personality level below which insulin therapy would be ineffective. He contended that the improvement with treatment varied inversely with the deviation of the patient's personality from the norm of healthy adults.

Subsequent investigations led Piotrowski (1941) to select six signs as being the most highly prognostic in value. The signs related to the intellectual and emotional traits, and it was postulated that the greater the intellectual deterioration the smaller the chance of improvement and the greater the emotional regression the better were the chances for improvement with the insulin coma treatment of schizophrenia.

Halpern (1940) carried out Rorschach studies on 17 male schizophrenics treated by insulin coma therapy and found significant differences in Rorschach responses between improved and unimproved patients. The recovered and improved patients gave responses indicative of a greater variety of association and a willingness to enter into the task, an absence of blocking and inhibiting factors, a greater emotional range and greater capacity for empathy. She concludes that while the Rorschach test gives prognostic pointers, it could not be used for selecting patients for treatment.

In view of the lack of agreement on the precise value of the test in predicting outcome of treatment, a special Rorschach study was undertaken of schizo-

phrenic patients treated by different methods of treatment with the aim of determining to what extent the test may be of value in assessing prognosis of schizophrenia treated by various methods.

MATERIAL.

The material of the study consists of the following groups of patients :

35 patients treated by insulin coma therapy comprising 35-50 comas.

19 patients treated by electronarcosis comprising 12-24 treatments.

22 patients treated by electroconvulsive therapy consisting of 12-24 treatments.

10 patients treated by prefrontal leucotomy.

METHODS.

The Rorschach test was given by A. M. J., using the standard method, and the assessment of clinical status, degree of recovery and follow-up investigation was carried out independently by L. R. The Rorschach and clinical data were finally transcribed to punched cards and analyses carried out by the Hollerith sorting machine.

The assessment of response to treatment was made at two stages, firstly the immediate results assessed after cessation of treatment, and secondly follow-up studies carried out at intervals up to 3 years.

The immediate results were classified as follows :

1. Recovered : This indicated freedom from symptoms and signs, and assessed as probably being able to return to previous or equivalent employment.

2. Improved and discharged : Able to return to previous social environment in spite of presence of minor signs.

3. Improved, remaining in hospital.

4. Not improved.

The follow-up assessments were graded as follows :

(1) Total recovery : Freedom from symptoms and signs. Return to previous social environment and to previous or equivalent occupation.

(2) Social recovery : Able to return to same or equivalent occupation in spite of minor symptoms and signs.

(3) Social defect : Presence of minor signs or symptoms, with incapacity to carry out work of previous level and failure to maintain self in same degree of social adaptation.

(4) Family invalids were those patients with well-marked symptoms and incapacity to carry out any useful occupation, but manageable at home.

(5) Hospital invalid : Those relapsed and readmitted to hospital.

The Rorschach responses were analysed and assessed by two methods. In the first method the prognostic signs described by Piotrowski (1941) were used, and in the second the modified Rorschach method described by Munroe (1945). The latter method was chosen, as it afforded a relatively objective method of assessing the various responses in terms of deviation from the normal and provided a total index of "abnormality" which might be prognostically valuable.

RESULTS.

Application of Piotrowski's (1941) Criteria.

The following Rorschach signs were selected by Piotrowski for predicting success or failure in the treatment of schizophrenia by insulin coma therapy :

1. Variety (Vrt) : This is when no percept is used more than twice.
2. Generic term (GT) is applied when the patient is aware of the difference between generic and specific terms, recognizing the existence of a logical hierarchy.
3. Evidence (Evd) that the patient is conscious of the distinction between a percept and its respective ink-blot.
4. Colour response (CR), colour being a contributing determinant.
5. Indirect colour approach (IC) when there is an evasion of colours of emotional attitude in reference to colours.
6. Demurring (Dmr) when there is withholding of interpretations for fear of failure or embarrassment.

Piotrowski claimed that if three or more of the signs were present, improvement could be expected with insulin coma therapy, giving a predictive accuracy of 93.3 per cent.

Taking three or more signs as the criterion for predicting improvement the following results were obtained :

TABLE I.

Treatment.	Number.	χ^2 .	P.
Insulin coma therapy	35	0.63	Between 0.3 and 0.5
Electronarcosis	19	0.2	" 0.5 " 0.7
Electroconvulsive therapy	22	0.17	" 0.7 " 0.8
Leucotomy	10	1.6	" 0.2 " 0.3

The results are well below even the 5 per cent. level of significance. The correct forecasts therefore could have been due to chance.

Inspection Rorschach.

The inspection Rorschach method of Munroe (1945) is an objective and rapid method of scoring and rating Rorschach responses. The method is derived directly from the standard method of Rorschach and based on the fundamental principles of Rorschach interpretation.

The method takes into account the fact that individual items in themselves are rarely of value, and that evaluation of the response either in relationship to normal people or in relation to other types of response is more valuable. The main difference from the standard Rorschach procedure is in method of tabulation. Special importance is attached to responses outside the normal range. One check is entered for each item which deviates from the normal range, and two or even three checks of the deviation is extreme.

Table II gives the distribution of the number of responses.

It will be seen that no patient who fully recovered gives over 31 responses, whereas 24 per cent. of the unimproved group gave over 31 responses.

Taking responses under 10 we find that there are no significant differences between recovered and unimproved groups.

TABLE II.

Number of responses	0-10.	11-20.	21-30.	31.
<i>Total Group.</i>				
Recovered, 9	44.4	22.2	33.0	0
Improved and discharged, 24	20.8	50	12.5	16.6
Improved, remaining in hospital, 5	20	40	20	20
Not improved, 50	40	26	10	24
<i>Insulin Coma Therapy.</i>				
Recovered, 5	40	20	40	0
Improved and discharged, 11	18	45	18	18
Improved, remaining in hospital, 0	—	—	—	—
Not improved, 19	31.6	36	5	26
<i>Electroconvulsive Therapy.</i>				
Recovered	}7	42	58	—
Improved and discharged				
Improved, remaining in hospital, 2				
Not improved, 15	40	27	6.5	26.5
<i>Electronarcosis.</i>				
Recovered	}6	33	16.5	33
Improved and discharged				
Improved, remaining in hospital				
Not improved, 12	42	16	16	24
<i>Leucotomy.</i>				
Recovered	}4	—	75	—
Improved and discharged				
Improved, remaining in hospital, 2				
Not improved, 4	75	—	25	—

	TR.	Refusal.	W.	Dd.	S.	PP. Com.	At. Sex.	R.
<i>Total Group.</i>								
Recovered	22.2	66.6	11	11	0	77.7	88.8	
Improved and discharged, 24	8.3	37	29	8.3	12.5	70	37	
Improved, remaining in hospital, 5	20	40	40	20	20	60	80	
Not improved, 50	34	46	34	8	16	68	46	
<i>Insulin Coma Therapy.</i>								
Recovered, 5	40	80	20	20	0	80	80	
Improved and discharged, 11	9	27	36	18	27	62	36	
Improved, remaining in hospital, 0	—	—	—	—	—	—	—	
Not improved, 19	26	47	32	10	15	64	42	
<i>Electroconvulsive Therapy.</i>								
Recovered	}7	—	70	14	0	70	28	
Improved and discharged								
Improved, remaining in hospital, 2								
Not improved, 15	27	39	40	8	20	67	40	
<i>Electronarcosis.</i>								
Recovered	}6	—	33	15	0	66	66	
Improved and discharged								
Improved, remaining in hospital, 1								
Not improved, 12	50	41	33	8	8	74	74	
<i>Leucotomy.</i>								
Recovered	}4	25	50	25	—	75	75	
Improved and discharged								
Improved, remaining in hospital, 2								
Not improved, 4	50	75	50	—	—	75	0	

Average Time per Response.

From Table III it will be seen that the percentage of responses with an average time of over 60 seconds is higher in the not improved group than recovered groups (34 per cent. and 22.2 per cent. respectively critical ratio (CR) = 0.7).

The various treatment groups conform to this trend but none of the differences are statistically significant.

Refusal.

This is recorded if the patient fails to find any response to one or more cards, and suggests severe blocking.

The most striking differences are found in the insulin-treated group (recovered, 80 per cent. ; not improved, 47 per cent.). The difference, however, does not reach statistical significance (CR = 1.6).

Thus in schizophrenia treated by insulin coma therapy the patients who recover show evidence of a greater incidence of blocking than the not improved group.

Whole Responses (W).

In Table III the percentage of patients giving over 60 per cent. whole responses is shown. The differences are not statistically significant.

Piotrowski (1938) found that improved patients had more of whole and less of detailed responses, but this was not borne out in our series.

F.	FK.	KK.	FM.	FM. M.	Lack of total movement.	Colour shock.	FC.	CF.	CF. FC.	Cn.	Total colour.	Colour Movement.	
												+	-
22	44.4	33	22	11	22	22	77	0	11.1	55	33	0	33
41	45	57	70	0	78	8.3	79	0	12.5	25	66	8.3	12.5
40	40	40	60	0	80	0	60	0	0	20	60	20	20
40	26	46	44	6	66	0	70	8	14	18	54	26	30
20	60	20	20	20	20	0	80	0	20	60	40	0	40
36	64	54	54	0	72	9	100	0	9	45	45	9	54
42	10	52	47	5	63	0	63	10	15	20	47	26	26
15	39	39	85	0	85	28	70	0	14	14	70	0	42
26	27	40	40	6.5	60	0	80	13	20	26	40	27	20
50	15	66	50	0	50	15	85	—	—	50	50	15	30
50	50	41	50	8	74	0	58	—	8	8	74	58	16
75	25	75	75	—	75	—	25	0	25	0	100	0	50
50	25	50	25	—	75	—	100	0	0	0	75	0	25

Responses using Small or Rare Details (Dd).

These responses represent an important break in the normal spatial gestalt of the blots. The differences shown in Table III in this feature are not significantly different.

Use of White Spaces (S).

This represents a reversal of figure and ground and is regarded as indicating an oppositional tendency. None of the fully recovered patients showed this feature. It is interesting to note that in the insulin group the improved and discharged group had a higher incidence of this feature than the unimproved group although the difference is not statistically significant.

Popular and Common Responses (P.Com.).

This refers to responses very frequently given by normal people. Failure to see a fair proportion of the blots more or less as other people see them is one measure of abnormality or eccentricity. The proportion of popular and common responses shows no significant differences between the various groups.

Anatomy and Sex Responses (At.Sex).

The recovered group has a statistically significantly higher incidence of anatomy and sex responses (Table III) than the unimproved patients (CR is over 3). The difference is particularly striking in the insulin group.

Form Only.

The percentage of responses using the shape or form of the blots only is interpreted as an indication of "rational" conscious control (Munroe, 1945). The improved and discharged patients have a significantly higher evidence of this feature than the unimproved patients (CR = 2).

Form Quality.

Bad form quality was found in 40 per cent. of the unimproved patients compared with 22.2 per cent. of recovered patients (CR = 1.1).

Shading Area.

Responses using shading as subordinate to form (FK) are regarded as indicating a more refined emotional control than pure F responses. An absence of (FK) is higher in the recovered than not improved groups (44.4 per cent. recovered, 26 per cent. not improved. CR = 1.0).

Vista responses (Fk) also showed no significant differences.

Movement Area.

Seeing action in the blots appears to involve a certain empathy and a projection of the subject's inner feelings.

Human figures in action (M) were found in 72 per cent. of the unimproved patients and only 33 per cent. of recovered patients (CR = 2). This is surprising, as M responses are usually regarded as stabilizing factors in personality and were found by Piotrowski (1938) to be prognostically favourable.

Seeing animals in action (FM) appears to reflect more primitive immature inner strivings. Absence of FM is regarded as an undesirable feature, and was found in 44 per cent. of the unimproved group and 22 per cent. in the recovered group. This difference is not statistically significant ($CR = 1.4$).

The ratio of animal (FM) to total movement (M) gives a measure of emotional immaturity, immaturity being indicated when FM responses are greatly in excess of M responses. The ratio of FM to M responses showed no significant differences.

Total Movement (M).

The unimproved patients showed an absence of M compared in a significantly higher proportion than the recovered patients (not improved, 72 per cent. ; recovered, 33 per cent. $CR = 2.3$).

Total M responses indicate the extent to which the reactions of the patient are determined from within, i.e., from inner strivings rather than from immediate surroundings. An absence of M is therefore associated with failure to improve. The differences are particularly notable in insulin and electro-narcosis groups.

Colour Area.

Response to colour is interpreted as reflecting the emotional reaction of the subject to his surroundings. Sometimes the appearance of colour interrupts the flow of responses characteristic for the subject. Colour blocking was found in 22 per cent. of recovered and in none of the unimproved patients. Colour shock is regarded as being indicative of neurotic traits.

Colour used as subordinate to form (FC) suggests reasonable control of emotional responses. Lack of FC is regarded as an unfavourable personality feature, and was found in 77 per cent. recovered and 70 per cent. unimproved patients. The differences are not statistically significant.

There were no significant differences in CF responses—i.e., responses dominated by colour but form not altogether neglected. A preponderance of CF responses over controlled emotional responses (FC) is regarded by Munroe (1945) as an unfavourable personality feature. This did not show any significant differences.

A response which merely names the colours (Cn) is different from a meaningful colour response. This type of response occurred in a significantly greater proportion of recovered patients (55 per cent. recovered ; 18 per cent. unimproved. $CR = 2.1$). The difference is noteworthy in insulin and electro-narcosis groups.

Total Colour.

This gives an indication of the extent to which the subject reacts to immediate external stimulation in contrast to inner dictates.

The unimproved group had 54 per cent. with low colour response compared with 33 per cent. in recovered groups. This difference is not statistically significant.

The Ratio of Colour to Movement Responses.

The unimproved group had preponderance of movement to colour in 26 per cent. compared with *nil* in recovered groups.

Index of Abnormality.

The sum total of checks gives a composite measure of the individual's deviation from the norm.

It was found to be a valuable index of maladjustment in students by Munroe, and had high predictive value in forecasting success in College. Taking 15 checks as a suitable point of demarcation we find marked differences in recovered and unimproved groups.

TABLE IV.

Number of checks.	Recovered.					Improved.					Not improved.				
	Total.	I.C.T.	E.N.T.	E.C.T.	Leucotomy.	Total.	I.C.T.	E.N.T.	E.C.T.	Leucotomy.	Total.	I.C.T.	E.N.T.	E.C.T.	Leucotomy.
Less than 15	55.5	40	100	50	0	16.5	18	25	50	0	24	26	25	20	25
Over 15	44.5	60	0	50	0	83.5	82	75	50	100	76	74	75	80	75

It will be seen that 76 per cent. of the not improved group had over 15 checks compared with 44.5 per cent. of the recovered group. This difference approaches statistical significance ($CR = 1.7$).

The unimproved group has therefore a higher proportion of patients with marked deviation from the normal in Rorschach responses.

It is noteworthy that 60 per cent. of the recovered insulin-treated patients had over 15 checks, whereas none of the E.N.T. patients who recovered had over 15 checks.

Improvement not amounting to full recovery did not show this trend, and 83.5 per cent. had over 15 checks compared with 44.5 in recovered and not improved groups. The improved patients are more similar to not improved patients in distribution of total number of checks.

It is interesting to note that follow-up results showed that the improved patients had a higher tendency to relapse than recovered patients.

While such differences are found it remains to be seen how useful the criterion can be on predicting recovery or failure to improve with various methods of treatment.

Taking 15 checks and over as a criterion for predicting failure and under 15 checks as predicting success, we find that—

Total group	$\chi^2 = .0007$	$P = > .95$
Insulin coma therapy	$\chi^2 = .09$	$P = \text{between } .7 \text{ and } .8$
Electroconvulsive therapy	$\chi^2 = .0009$	$P = .99$
Electronarcosis	$\chi^2 = .28$	$P = \text{between } .5 \text{ and } .7$
Leucotomy	$\chi^2 = .03$	$P = \text{between } .7 \text{ and } .8$

Thus the correct predictions are no better than could be accounted for by chance.

SUMMARY.

(1) The Rorschach test was given before treatment to groups of schizophrenic patients due to receive insulin coma therapy, electronarcosis, electroconvulsive therapy and prefrontal leucotomy. Clinical status, degree of recovery and follow-up assessment were carried out independently by standardized procedures.

(2) The Rorschach responses and clinical data were transcribed to punched cards and analyses carried out by the Hollerith machine.

(3) The criteria described by Piotrowski were applied and their forecasting efficiency subjected to statistical analysis. The results could have been attributable to chance.

(4) A detailed analysis of responses using the modified Rorschach method of Munroe was carried out. A number of features showed statistically significant differences between the recovered and not improved groups, but none of these showed a statistically significant predictive value.

(5) The investigations show that there are significant differences between the pre-treatment Rorschach responses between schizophrenics who recover and those who fail to improve with various methods of treatment, but provides no evidence that the test is of value in selecting patients for treatment.

REFERENCES.

- HALPERN, F., *Psychiat. Quart.*, 1940, **4**, 826.
MUNROE, L., *Adjustment and Academic Performance of College Students*, 1945. Stanford Univ. Press.
PIOTROWSKI, Z. A., *Psychiat. Quart.*, 1938, **12**, 679.
Idem, *Psychosom. Med.*, 1939, **1**, 508.
Idem, *Psychiat. Quart.*, 1940, **14**, 267.
Idem, *ibid.*, 1941, **15**, 807.
-

QUANTITATIVE EVALUATION OF PSYCHO-SOCIAL PHENOMENA IN SMALL GROUPS.

By F. KRÄUPL TAYLOR, M.D., D.P.M.,

The Bethlem Royal Hospital and the Maudsley Hospital.

INTRODUCTION.

THE widespread use of group treatment as one of the modern methods of psychotherapy has provided us with an opportunity to study psycho-social phenomena in a fairly uniform social setting.

The techniques employed in this form of treatment vary according to the type of patients treated and the aims of the therapist. The groups examined here consisted of adult neurotic out-patients, and the therapeutic method applied resembled that described by Foulkes (1948) as "group-analytic psychotherapy." The general social atmosphere and field structure of such groups is fairly uniform in spite of differences in the group composition and in the personality of the therapist who conducts the groups. The number of patients in a group ranges from 5 to 12. The therapist and the patients sit in a circle and there is little or no social mobility. It happens only infrequently that the habitual seating arrangement is altered by one or the other patient. The main activity is verbal, and consists in the discussion of personal and emotionally charged topics. The therapist leaves the choice of topic to the patients, and merely guides or clarifies the spontaneous trend of the conversation. His role is similar to that of the "democratic leader" in the experimental groups of Lewin, Lippitt and White (1939), and a comparable "social climate" might therefore be assumed to exist in group-analytic sessions.

The phenomena which can be noticed in therapeutic groups vary according to the person who acts as observer. There are three possible categories of observers—the therapist, independent observers, and the group patients themselves. Each observer category has its own merits and demerits, but for each there exists an area of group phenomena which they are best qualified to record. Though the different classes of observers are inclined to discount the significance of observations made in spheres outside their own competence, their findings may be considered to be largely complementary.

The group therapist's prime concern and competence lies in the recognition of the subtle undercurrents of motivation which he infers from a large variety of manifest phenomena. The breadth of his interest has, however, the disadvantage that individual bias may lead different therapists to attend to different sets of phenomena and hence to arrive at apparently divergent interpretations. They are also liable to express their findings in the terminology of different psychopathological theories, and may therefore give the impression to other observer categories that their findings are conflicting and unreliable.

The objective recordings of independent observers are frequently regarded as scientifically superior because their reliability can be easily estimated. Yet their competence is limited to group phenomena which are conspicuously manifested and can be readily recognized. When they are required to score emotional group events which are only vaguely objectified, their concordance, and with it their reliability, may be assumed to become less satisfactory.

Group patients themselves, as will be shown, are also fairly reliable observers of conspicuous group phenomena. In addition, they have the unique qualification of being able to record, through introspective observation, private phenomena which may remain, for the most part, unrevealed, and therefore hardly available to the objective observation of outsiders. Their handicap is their emotional bias and their resistance against self-awareness.

In this paper group patients will be exclusively used as observers, and their observations will be concerned both with the introspective recording of private feelings and the objective assessment of publicly manifested phenomena.

The group phenomena we want to study are those psychosocial trends which emerge from interpersonal contact between pairs of individuals and from the reciprocal inter-actions which take place between the group as a whole, on the one hand, and individual members, on the other. Such group trends refer either to attitude differences among members, or to differences in the attitude which individuals evoke in their fellow members or the group as a whole.

The field conditions and the cross-sections of personality in the therapeutic groups examined here have been fairly comparable, apart from differences in sexual composition. Aggregate trends have been formed which comprise the members of all our groups. These aggregate trends could be correlated *in toto* when they ran parallel in men and women, but where there were sexual differences in response, separate aggregate trends for the two sexes had to be examined. We were thus enabled to deal with populations which were larger than those composing individual groups. The correlations we obtained may therefore often have a fairly wide validity.

THE INVESTIGATED GROUP POPULATION.

Three therapeutic groups of neurotic out-patients were examined: a female group of 7 members, a male-female group consisting of 4 men and 4 women, and a male group of 9 members.

The groups met once a week for sessions of $1\frac{1}{2}$ hours. They were conducted by different therapists.

The investigation took place after about 3 months of unchanging group membership. It was assumed that the patients would, by then, have grown sufficiently accustomed to each other, and have become sufficiently familiar with the group phenomena they were required to assess.

One group session at which, as far as possible, all members were present was devoted to the recording of the patients' introspective and objective assessments of group phenomena. The patients were found to be very co-operative, as they assumed that their endeavours to make correct and sincere assessments would assist the therapist in the conduct of the group sessions and that they

would ultimately benefit by it. Some obsessional patients had subsequent doubts about the accuracy of their scores, but they were not permitted to alter their first responses.

The investigation consisted of a questionnaire test and various ranking tests and estimates of personal status. The questionnaire contained 50 items, of which, however, only a few have been used in this analysis. Each questionnaire probed the feelings and opinions a patient had for one of the other patients. Every patient, therefore, had to complete as many questionnaires as there were members, apart from himself, in the group.

THE MATRIX OF INTERPERSONAL FRIENDLINESS.

This part of the investigation is based on the introspective recording of interpersonal friendly feelings. It is in many ways similar to the type of sociometric investigations which have been carried out by Moreno (1934) and his associates. There are, however, differences both in the method of collecting the data and in the manner of evaluating them.

Our data were obtained from the following four items of the questionnaire test: (1) Would you choose him (or her) as a friend, that is to say, would you want to meet him (or her) regularly and not just at group sessions? (2) Even if you do not choose him (or her) as a friend, would you say you like him (or her)? (3) Do you dislike him (or her)? (4) Do you think he (or she) is a pleasant person?

The answers to these questions could be Yes, No, or Doubtful. They were scored in such a manner that a reply indicating friendliness (or absence of dislike) was given the score + 1, a reply indicating dislike (or lack of friendly feelings) the score - 1, and a doubtful reply the score 0. The individual scores could thus range from + 4 to - 4.

The scores were arranged in matrix form as is illustrated in the example of Table I which was obtained from the male group of 9 members.

TABLE I.—*Matrix of Interpersonal Friendliness.*

	M ₁	M ₂	M ₃	M ₄	M ₅	M ₆	M ₇	M ₈	M ₉	" Friendly " bias.	
M ₁ liking	..	+2	+2	+2	+2	+2	+2	+2	+1	.	+ 15
M ₂ "	+4	..	+2	-1	+2	-2	+1	+1	+2	.	+ 9
M ₃ "	+2	-1	..	+1	+4	+2	-4	+2	-2	.	+ 4
M ₄ "	+3	+4	+4	..	+2	+4	+2	0	-2	.	+ 17
M ₅ "	+4	+4	+2	+2	..	-4	+2	-4	+2	.	+ 8
M ₆ "	+4	+4	+4	+4	-2	..	+2	+2	+2	.	+ 20
M ₇ "	+4	+4	+4	+4	+4	+4	..	+1	+2	.	+ 27
M ₈ "	0	+4	+4	0	-4	-2	0	..	-2	.	0
M ₉ "	+4	+4	+2	+4	+4	+4	-1	-2	..	.	+ 19
Interpersonal popularity	+25	+25	+24	+16	+12	+8	+4	+2	+3	.	+119

The scores of interpersonal friendliness are contained in the rows of the matrix. For instance, the friendly feelings which patient M₅ had for M₁ and M₂ obtained the highest possible score of + 4, whereas he apparently disliked M₆ and M₈ whose score was - 4.

The matrix is a square one consisting of n rows and n columns (n = number of patients in the group). The cells in the principal diagonal remain blank as there were no scores of friendliness towards oneself.

If we had used Moreno's sociometric test which inquires into the choice of associates, the resulting "sociomatrix" would have contained many more blank cells. It is one of the advantages of the small size of therapeutic groups that the patients can be asked to record their feelings towards every one of the other group members, so that we can obtain a complete matrix of the interpersonal feelings of friendliness. This facilitates the task of mathematical evaluation.

The interest of sociometrists has been predominantly focussed on the pattern of interpersonal relationships which is contained in the matrix scores. If it were our intention to depict the particular network of interpersonal affiliations which emerges in a group, then a sociomatrix, like the one shown in Table I, would not suit our purpose well. In fact, Moreno (1946) has criticized the use of socio-matrices on the ground that they are inferior to his sociograms in revealing the interconnections which exist between the members of a particular group. On the other hand, a sociogram is merely a cartographic device to demonstrate a particular group constellation. A sociogram is of little use if it is desired to elicit group trends which might have relevance for other groups as well. For such purposes sociomatrices and their manipulations by matrix algebra have been found useful, for instance by Forsyth and Katz (1946) and by Katz (1947) in an endeavour to elucidate subgroupings, and by Festinger (1949) and Luce and Perry (1949) in an examination of mutual choices and such sociometric configurations as chains, triangles, and so on.

THE TREND OF INTERPERSONAL POPULARITY.

The scores in any one column of a matrix of interpersonal friendliness represent the friendly feelings which an individual patient receives from each of his fellow members. The sum of the scores in a particular column may, therefore, be regarded as a measure of that particular patient's popularity in interpersonal relationships. The distribution of these column sums in a group will then indicate the trend of interpersonal popularity in that group. An example of such a distribution is shown in the bottom marginal row of the matrix of Table I.

It should be noted that each component value of this trend was obtained by summing the scores made by all but one patient; it is therefore a "group-scored" trend.

In Table I the patients M_1 and M_2 share the value + 25, which is the highest trend value of interpersonal popularity in our male group, whereas patient M_8 has the lowest value of + 2.

The sociometrists have dealt with an incomplete trend of this kind, calling the person who receives the greatest number of choices the "star" or "leader," and that person who is not chosen by any other group member the "isolate."

The trend of interpersonal popularity obtained by us has the advantage that it is not restricted to the extremes of highest and lowest popularity, but indicates the distribution of the trend in the whole group.

The trend as shown in Table I needs, however, some corrections. It is necessary, first of all, to eliminate potential distortions due to the varying readiness among group members to score friendliness. We therefore have to consider briefly this distribution of "friendly" bias.

THE DISTRIBUTION OF "FRIENDLY" BIAS.

This distribution is shown in the right marginal column of the matrix of Table I. It was obtained by summing the scores in the matrix rows.

In contrast to the trend of interpersonal popularity, the component values of this distribution are not "group-scored." Each value is derived exclusively from the scores of only one patient. It is therefore a "self-scored" distribution.

It will be seen that the members of our male group differ widely in their "friendly" bias. Patient M_7 , who has a bias score of $+27$, was most ready to profess friendly feelings; he gave the highest matrix score of $+4$ to six of his eight fellow members. On the other hand, patient M_8 , whose bias score is zero, showed marked differences in his matrix scores and, as a result, his score total is low.

We will deal with this "friendly" bias in more detail later on. At present we are merely concerned with the potential distortion that this variation of "friendly" bias might cause in the trend of interpersonal popularity.

That there is a possibility of distortion is due to the fact that there are no scores in the principal diagonal of our matrix of interpersonal friendliness. An extreme example will help to illustrate this point.

Let us assume that a patient A gives the uniform score of $+4$ to each of the other members in his group, and that a patient B scores them all equally as -4 . If we now consider how much these patients contribute to the values in the trend of interpersonal popularity, we find that they contribute nothing to the popularity values of all the other group members because their scores of $+4$ and -4 cancel each other, but the popularity status of A will appear unduly low owing to B's score of -4 , which is not cancelled by a score in the blank cell of A's row. B's popularity status, on the other hand, will be spuriously high on account of A's contribution to it of $+4$. Thus it appears as though A is penalized for his "friendly" bias, whereas B gains an unjustified advantage by his reluctance to admit friendly interpersonal feelings.

To obviate this possibility of distortion we have to eliminate the influence of the variation in "friendly" bias on the trend of interpersonal popularity. This means we have to equalize the sums of the matrix scores in each row.

THE SECONDARY RANK MATRIX OF INTERPERSONAL PREFERENCES.

This equalization was achieved by a transformation of the original matrix scores in each row into secondary rank scores. The group member who received the highest original score in the row of patient A was accorded the rank 1, the group member liked second-best by A the rank 2, and so on. Thus, the lower the rank score the higher the degree of friendliness indicated, and vice versa.

Original matrix scores which were of the same magnitude were given equal rank scores ("tied ranks") by averaging the rank scores they would have had,

if it had been possible to rank them consecutively. For instance, if A had given the highest original score of + 4 to two members, these two members would share the rank score $1\frac{1}{2}$, i.e., the average of the ranks 1 and 2.

This transformation ensures that the sum of the scores in each row is identical and equal to $\frac{1}{2}n(n-1)$ (n = number of persons in the group). The variation in "friendly" bias is thus eliminated.

The scores in each row of the new matrix are no longer absolute scores of interpersonal friendliness, but relative scores of interpersonal preferences. The new matrix has been called "secondary rank matrix of interpersonal preferences." The term "preference" emphasizes that we are now dealing with relative degrees of friendliness. The term "secondary" has been introduced, partly in order to indicate that this matrix was obtained by secondarily transforming absolute into rank scores, and partly in order to distinguish this matrix from a corresponding "primary rank matrix" which we shall encounter presently.

Table II shows the secondary rank matrix of interpersonal preferences which was derived from the matrix of Table I.

The transformed trend of interpersonal popularity, obtained by summing the secondary rank scores in the columns of the new matrix, is contained in the first marginal row at the bottom of Table II. Such a transformed scale will be briefly called a "*t*-scale." It should be noted that the lower a value in the *t*-scale of interpersonal popularity, the higher the popularity status indicated by it, and vice versa. Patient M_1 , with a *t*-value of 22.5, appears now to be slightly superior in interpersonal popularity to patient M_2 , whose *t*-value is 24, whereas previously these two patients seemed to be of equal status. There are other minor changes in the *t*-scale as compared with the untransformed distribution.

A COMMON METRIC FOR GROUPS OF DIFFERENT SIZE.

So far we have dealt with a particular trend in a particular group. It is, however, our purpose to examine the general significance of group trends irrespective of any peculiarities individual groups might have. This, as was pointed out in the Introduction, is feasible because of the fairly uniform field milieu in treatment groups which are conducted on similar therapeutic lines.

The *t*-values which we have obtained by the method described are, however, dependent on a variable group characteristic, namely, the size of the group in which they are measured. For example, the lowest possible *t*-value in a group of n members is $(n-1)$, the highest possible *t*-value $(n-1)^2$. Thus, a patient with the highest possible status of interpersonal popularity in a group of 7 members will have the *t*-value 6, whereas a patient of equivalent status in a group of 9 members will have the *t*-value 8.

We therefore have the task of finding a common metric for the measurement of *t*-values, which will eliminate the influence of group size.

To achieve this purpose it was decided to measure *t*-values as deviations from the lowest possible value of $(n-1)$, and to express these deviations as percentages of the highest possible deviation, which is $(n-1)^2 - (n-1) = (n-1)(n-2)$.

TABLE II.—*Secondary Rank Matrix of Interpersonal Preferences.*

	M ₁	M ₂	M ₃	M ₄	M ₅	M ₆	M ₇	M ₈	M ₉
M ₁ preferring (in secondary rank order)	..	4	4	4	4	4	4	4	8
M ₂ "	I	..	3	7	3	8	5.5	5.5	3
M ₃ "	3	6	..	5	1	3	8	3	7
M ₄ "	4	2	2	..	5.5	2	5.5	7	8
M ₅ "	I.5	I.5	4.5	4.5	..	7.5	4.5	7.5	4.5
M ₆ "	2.5	2.5	2.5	2.5	8	..	6	6	6
M ₇ "	3.5	3.5	3.5	3.5	3.5	3.5	..	8	7
M ₈ "	4	I.5	I.5	4	8	6.5	4	..	6.5
M ₉ "	3	3	6	3	3	3	7	8	..
<i>t</i> -scale of inter personal popularity	22.5	24	27	33.5	36	37.5	44.5	49	50
<i>t_p</i> -scale	25.89	28.57	33.93	45.54	50.00	52.68	65.18	73.21	75.00

TABLE III.—*Primary Rank Matrix of Interpersonal Preferences.*

	M ₁	M ₂	M ₃	M ₄	M ₅	M ₆	M ₇	M ₈	M ₉
M ₁ preferring (in primary rank order)	..	4	4	4	4	4	8	4	4
M ₂ "	I	..	3	7.5	2	5	6	7.5	4
M ₃ "	3	4	..	5	I	6	7	2	8
M ₄ "	2.5	5	I	..	7	2.5	4	6	8
M ₅ "	I	3	2	4.5	..	7	6	8	4.5
M ₆ "	3	3	3	3	8	..	3	6	7
M ₇ "	7	I	6	3	4.5	2	..	4.5	8
M ₈ "	I.5	3	I.5	7	8	6	4	..	5
M ₉ "	4	3	6	5	2	I	7	8	..
<i>t</i> -scale of interpersonal popularity	23	26	26.5	39	36.5	33.5	45	46	48.5
<i>t_p</i> -scale	26.79	32.14	33.04	55.36	50.89	45.54	66.07	67.86	72.32

The formula which transforms t -values into percentage values (t_p) is—

$$t_p = 100 \frac{t - (n - 1)}{(n - 1)(n - 2)}$$

The t -value of a patient who obtains the lowest possible value of $(n - 1)$ in his group, whatever its size, will be zero, whereas the highest possible value of $(n - 1)^2$ will be transformed into a t_p -value of 100. The average t -value in any group is $\frac{1}{2}n(n - 1)$, and this leads to a t_p -value of 50 irrespective of the size of the group.

It must be admitted that this transformation does not completely remove all the differences of measurement due to variations in group size. A t_p -value is not a continuous variable; it changes discretely, and the amount by which it can change varies with group size. This slight inaccuracy is unavoidable, but the error introduced by it is negligible compared with other errors and uncertainties which are inherent in this type of investigation.

Table II shows, in its lowest marginal row, the t_p -distribution of interpersonal popularity in the male group.

As the t_p -values in the three groups under examination are comparable, an aggregate t_p -scale of interpersonal popularity can be formed comprising all the 24 patients in our groups.

THE RELIABILITY OF TESTS OF INTERPERSONAL POPULARITY.

To assess the reliability of interpersonal popularity, the t_p -scale obtained from the questionnaire test was correlated with a t_p -scale which was based on another test of interpersonal popularity.

This second test was a test of preference ranking. The patients were instructed to rank their fellow members in the order in which they liked them. They were asked to indicate any uncertainties in ranking, and such doubtful ranks were treated as "tied" scores.

From these data was obtained a "primary rank matrix" of interpersonal preferences, and an example of such a matrix (taken from our male group) is represented in Table III.

We therefore have two estimates of interpersonal popularity which comprise all the members of our three groups, and which are based, respectively, on the questionnaire test and the test of primary ranking.

The correlation* between the two t_p -distributions was $+0.91$. If we regard the two tests as equivalent in length and combine their results by using the means of corresponding t_p -values in the two distributions, the reliability of the combined test is increased to $+0.95$ (using the Spearman-Brown prophecy formula for this correction).

This combined t_p -scale will be used subsequently as the best estimate of the distribution of interpersonal popularity in all three groups. This scale is shown in Table IV.

* All the correlations in this paper are product-moment correlations unless otherwise stated.

TABLE IV.—*Distribution of Interpersonal Popularity.*

Group members*	M ₁	F ₁	F ₂	M ₂	M ₃	F ₃
<i>t_p</i> -value	26.34	28.34	30.00	30.36	33.49	34.17
Group members*	MF ₁	FM ₂	MF ₃	FM ₄	MF ₅	M ₆
<i>t_p</i> -value	35.73	36.31	37.50	43.46	46.05	49.11
Group members*	M ₄	M ₅	F ₄	FM ₆	F ₆	M ₇
<i>t_p</i> -value	50.45	50.45	51.67	56.55	56.67	65.63
Group members*	FM ₇	M ₈	M ₉	F ₆	F ₇	MF ₈
<i>t_p</i> -value	69.65	70.54	73.66	74.17	75.00	76.79

* M = member of male group. F = member of female group. MF = male member of male-female group. FM = female member of male-female group.

The numerical subscripts correspond to the status of interpersonal popularity which was derived from the questionnaire test alone.

THE TREND OF PUBLIC POPULARITY.

The tests we have applied so far were intended to elucidate a particular type of popularity, namely the popularity trend which emerges from the network of interpersonal feelings.

There exists, however, another type of popularity which does not have its origin in interpersonal feelings, not—at least—in the narrow sense in which we are using the term “interpersonal” as indicating a person-to-person relationship only. The second type of popularity derives from a public interaction and is analogous to the actor-audience relationship. In our particular case it derives from the feelings a patient evokes in the group audience by his public role as a group member. It will be called public popularity to distinguish it from the interpersonal popularity with which we have been concerned up to now, and which has a more private meaning.

Theoretically these two types of popularity may be considered as—at least potentially—-independent trends, because interpersonal popularity is theoretically based on the *introspective* observation of *interpersonal* feelings towards an individual in his role of a *private* companion, whereas public popularity is theoretically based on the *objective* observation of *group* feelings towards an individual in his *public* role as a group member. Yet, in spite of these theoretical contrasts, one cannot expect that investigations will actually reveal these popularity types as independent trends. For this, the inadequacy of human observers is responsible. Introspective observation is bound to be influenced by the public attitude of the group, and the objective assessment of this public attitude is bound to be distorted by private emotional bias. That there is a practical advantage in distinguishing between interpersonal and public popularity has been demonstrated by some sociometrists, and particularly by Jennings (1947), who discriminates between “psyche-groups,” i.e., group trends indicating a desire to form relations on a “private personalized basis” and “socio-groups,” i.e., group trends indicating a desire to form relations on a “collective impersonal basis.”

To obtain *t_p*-scales of public popularity a questionnaire test and a test of primary ranking was again used.

The questions were: Do you think he (or she) is a popular person in the group, no matter whether you like him (or her) or not? Do you think he (or she) is an unpopular person in the group, no matter what you feel personally?

TABLE V.—Primary Rank Matrix of Public Popularity.

	M_1	M_2	M_3	M_4	M_5	M_6	M_7	M_8	M_9
M_1 estimating (in rank order)	.	.	.	.	.	.	.	.	.
M_2 "	I	.	.	4	8	4	4	4	4
M_3 "	I	.	3	5.5	2	5.5	7	8	4
M_4 "	I	3.5	.	5	7	6	3.5	2	8
M_5 "	I	4	3	.	5	2	6	7	8
M_6 "	I	5	4	3	.	7	6	8	2
M_7 "	I	3	2	5	4	.	6	7	8
M_8 "	I	3	4	5	2	8	.	6	7
M_9 "	I	3	2	7	7	7	5	.	4
t -scale of group popularity	8	28.5	24	38.5	40	46.5	43.5	50	45
t_p -scale	0.00	36.61	28.57	54.46	57.14	68.75	63.39	75.00	66.07

In the primary ranking test the members were asked to put down the names of the other members in the order of their estimated popularity in the group. The patients were enjoined not to allow their personal feelings towards another member to influence their judgment of his general popularity. Uncertainties of ranking could again be indicated and were treated as tied ranks.

The two t_p -scales had a correlation of .84. If a combined t_p -scale had been formed, as had been done in the case of interpersonal popularity, this coefficient of reliability would have been increased to .91.

Considerations will, however, be advanced later which suggest that the primary ranking test is significantly more adequate and leads to more valid results than the questionnaire test when a publicly determined phenomenon is rated by objective observation.

The estimation of the trend of public popularity will therefore be based exclusively on the primary ranking test.

Table V shows the primary rank matrix of public popularity in the male group, and Table VI the distribution of public popularity in all three groups.

TABLE VI.—*Distribution of Public Popularity.*

Group members*	M_1	F_1	MF_1	FM_4	F_3	F_2
t_p -value	0.00	15.00	16.67	17.86	25.00	28.33
Group members*	M_3	M_2	F_4	MF_5	FM_2	MF_3
t_p -value	28.57	36.61	36.67	39.29	46.43	52.38
Group members*	M_4	M_5	M_7	M_9	MF_8	M_6
t_p -value	54.46	57.14	63.39	66.07	67.86	68.75
Group members*	FM_6	M_8	F_5	F_6	F_7	FM_7
t_p -value	69.05	75.00	80.00	80.00	85.00	90.48

* For the key to the symbols of group membership see Table IV.

THE COEFFICIENT W .

When group members—or any other category of observers—rate, by objective observation, a public phenomenon, such as the attitude of the group which indicates the public popularity status of the various members, the resulting data are the more reliable the higher the degree of concordance among the observers. The degree of concordance may therefore be used as a criterion of observer reliability.

A coefficient W of concordance has been introduced and investigated by Kendall (1948). In his book *Rank Correlation Methods* he has published formulae and tables for the estimation of the statistical significance of this coefficient.

Kendall's coefficient W applies when n individuals are ranked by m observers. The rank scores are entered in a matrix of m rows (one for each observer) and n columns (one for each individual ranked). If the m observers agreed completely in their rankings, the sums of the various columns would be $m, 2m, 3m, \dots, nm$.

Measuring these sums as deviations from their mean (which is $\frac{1}{2}m(n+1)$), we obtain $-\frac{1}{2}m(n-1), -\frac{1}{2}m(n-3), \dots, \frac{1}{2}m(n-3), \frac{1}{2}m(n-1)$.

The sum of the squares of these deviations is given by $\frac{1}{12}m^2n(n^2-1)$, which is the highest possible value the sum of these squares may have.

Kendall's coefficient W of concordance is the ratio between the sum of squares of the deviations, which were obtained from a rank matrix, and the highest possible value of the sum of squares :

$$W = \frac{12S}{m^2n(n^2 - 1)}$$

(S = the sum of squares of the deviations obtained from a rank matrix).

This coefficient can unfortunately not be used by us without some modification, because it was derived from matrices which differed from those with which we are concerned here.

Our matrices are square in form so that m equals n . The principal diagonals in them are blank so that the rank scores in each row do not run from 1 to n , but only from 1 to $(n - 1)$. Therefore, if the rank scores in each row were in their natural order, the sums of the various columns would be—

$$(n - 1), (n - 1) + (n - 2), (n - 1) + 2(n - 2), \dots \\ \dots, (n - 1) + (n - 2)^2, (n - 1) + (n - 1)(n - 2).$$

Measuring these sums as deviations from their mean (which is $\frac{1}{2}n(n - 1)$) we obtain—

$$-\frac{1}{2}(n - 2)(n - 1), -\frac{1}{2}(n - 2)(n - 3), -\frac{1}{2}(n - 2)(n - 5), \dots \\ \dots, +\frac{1}{2}(n - 2)(n - 3), +\frac{1}{2}(n - 2)(n - 1).$$

The sum of the squares of these deviations is—

$$1/12 (n - 2)^2 n (n^2 - 1).$$

Therefore, the highest possible value the sum of squares may have in our matrices is smaller than that in the matrices on which Kendall's coefficient is based (equating m and n).

To form a comparable coefficient—which will be designated W' —the sum of squares of the values in our t -scale (measured as deviations from the average) has to be multiplied by $n^2/(n - 2)^2$ (t -scales are used here as the coefficient W' applies to individual groups only).

Our coefficient then becomes :

$$W' = \frac{12S'}{n^3(n^2 - 1)}$$

(S = the sum of squares of the deviations from average in a t -scale, multiplied by $n^2/(n - 2)^2$).

When tied rank scores are present in the rows of a matrix—and this is frequently the case in our matrices—this coefficient requires a correction. Following Kendall's considerations, we obtain the corrected formula :

$$W' = \frac{S'}{\frac{1}{12} n^3 (n^2 - 1) - n \sum_{T'} T'} \\ T' = \frac{1}{12} \sum_i (t^3 - t).$$

The letter t denotes the sets of ties in any one row. Thus, if there are two sets of ties in a particular row, of 2 and 3 items respectively, the value of T' would be $1/12 ((2^3 - 2) + (3^3 - 3)) = 2\frac{1}{2}$. The values of T' in all the rows are added to arrive at $\sum T'$ in the above formula for W' .

The significance of the values of W' can be approximately assessed with the aid of the formulae and tables given by Kendall.*

OBSERVER RELIABILITY.

The coefficient W' indicates the degree of concordance among observers, and is therefore a criterion of observer reliability when public phenomena, like public popularity, are rated.

The following values of W' were found in the primary rank matrices of public popularity: .72 in the female group, .54 in the male-female group, and .52 in the male group.

Each of these values is highly significant, the levels of confidence ranging from .0001 to .00001. The average value of W' in the three groups is .59.

There is therefore a highly significant degree of concordance among the patients' ratings of public popularity. Yet the average value of W' is not large enough to indicate an entirely satisfactory degree of observer reliability. It may be accepted as fairly satisfactory as far as the general trend of the distribution of public popularity is concerned, but not with regard to the particular status of individual patients. This statement is, however, valid only as a general suggestion. If we want to draw conclusions from the particular status of an individual patient, it is advisable to refer back to the rank scores in the matrix of public popularity. It seems that group members are more likely to agree in assessing a very popular or a very unpopular patient than in rating a patient whose popularity status falls within the middle range. Should we find that the matrix column of a patient contains the same rank score throughout, the reliability of his popularity status is certainly beyond question. An example of this kind is patient M_1 in Table V.

THE CONDITIONS DETERMINING OBSERVER RELIABILITY.

It seems advisable here to consider briefly the conditions which influence the reliability of observers in rating overt phenomena. The following factors appear to be of importance:

- (1) The competence of the observers in judging the phenomena in question. It cannot be claimed that group patients are particularly competent judges of public popularity. Better qualified observers are likely to achieve a higher degree of concordance in their rankings.
- (2) Freedom from emotional bias in judging group phenomena. Independent observers are likely to be superior to group patients as impartial raters.
- (3) The conspicuousness of the phenomena judged. The more conspicuous, and therefore the more easily recognizable, the phenomena are, the less competent

* I am indebted to Professor Kendall for this information. I would also like to acknowledge the assistance given to me by Mr. A. Lubin and Miss J. D. May, of the Statistical Laboratory, Institute of Psychiatry.

need the observers be and the less distortion will be caused by emotional bias. As a corollary it may be expected that, if the same observers rate two different phenomena, they will—*ceteris paribus*—show a higher degree of concordance when scoring the more conspicuous phenomenon.

(4) The adequacy of the test by which the phenomena are assessed. The better the instrument of observation the greater will be the concordance among observers. Thus, if the same set of observers examines a phenomenon by means of two different tests, one will expect a better concordance with the more adequate test.

THE COMPARATIVE ADEQUACY OF THE QUESTIONNAIRE AND PRIMARY RANKING TEST IN ESTIMATING OVERT GROUP PHENOMENA.

As stated in the preceding paragraph the comparative degree of concordance among observers can be used as a measure of the adequacy, and therefore also of the reliability, of tests designed to assess overt phenomena by objective observation.

When an observer is required, as in our questionnaire test, to judge several attributes of persons considering them each in turn, a disturbing "halo" effect will tend to influence his ratings, as he will be biased by his personal feelings towards the person whose qualities he is assessing. It has therefore been widely assumed that better rating estimates are achieved if the observers have to rate all people in a group with regard to one particular attribute rather than all attributes belonging to a particular person. Thus, we expect that the primary ranking test will be found more adequate as an instrument of objective rating than the questionnaire test.

This expectation is borne out by an examination of the values of W' . In the course of this paper we will deal with two publicly determined and overt trends assessed by objective observation, viz., public popularity and public dominance. Each of these trends was tested by both the questionnaire and the primary ranking procedure. From our three groups we thus obtained two sets of 6 coefficients W' , respectively derived from the secondary rank matrices of the questionnaire test and the primary rank matrices of the primary ranking test. It was found that all the 6 W' -values in the primary rank matrices were greater than those in the secondary rank matrices.

If the two test procedures were of equal exploratory power, one would expect the differences between the two sets of coefficients W' to have been partly positive and partly negative. The probability of a consistent difference, either positive or negative, in 6 values is $(\frac{1}{2})^5$, i.e., it would occur by chance about once in 32 trials. On the assumption that the primary ranking test is the more adequate exploratory device one could have predicted that the difference should be positive and not negative; the probability of this prediction being verified merely by chance is $(\frac{1}{2})^6$, i.e., once in 64 trials.

THE VALIDITY OF PUBLICLY DETERMINED GROUP TRENDS.

The degree of concordance among observers of objectively manifested phenomena has a twofold significance. It is, as we have seen, a criterion of

observer reliability. At the same time, however, it can serve as a criterion of the validity of test results, provided we can be certain that there is no semantic ambiguity in the meaning which the test conveys to different observers or in the interpretation of the test results by different investigators.

The procedure chiefly adopted in estimating the validity of data is to correlate them with other data which have been generally accepted as criterion measures of the phenomena in question. The ultimate criterion measure of many psychological and sociological phenomena is, however, the consensus of opinion among competent observers who are able to assess these phenomena under favourable conditions.

One may therefore ask: To what extent do the collective opinions of group members approximate the more correct assessments which could have been made by more competent persons under better conditions?

Kendall (1948) has given a partial answer to this question. He could show that the best available estimate of the correct or "true" ranking is obtained when the estimates of several observers are summed to form a scale of collective assessments (such as our t -scale) on condition that the coefficient of concordance is significant for this scale. It follows from his argument that, if we have reasons to assume that the difference between two coefficients of concordance is not due to chance, the higher coefficient will indicate the better approximation to the correct scale.

These considerations can be applied to our data. The average value of W' in our matrices of public popularity was very highly significant. It was also found that W' was consistently and significantly higher in the primary than the secondary rank matrices. It follows therefore that the distribution of public popularity which resulted from the primary ranking test can be accepted as representing the best available estimate of the correct distribution. This conclusion was, in fact, one of the chief reasons why we adopted the policy of basing the estimate of public popularity (and of other public trends of this kind) on the primary ranking test alone.

If we further assume that the phrase "popularity in the group" conveyed approximately the same meaning to the various group patients, we are justified in attributing a fair degree of validity to our scale of public popularity as far as its general trend is concerned.

THE DEGREE OF CONCORDANCE UNDERLYING THE TREND OF INTERPERSONAL POPULARITY.

The trend of interpersonal popularity derives from the complex pattern of paired relationships in groups. The crisscross network of sociograms clearly demonstrates that no high degree of concordance can be expected in this configuration. Yet some degree of concordance must be present before one can speak of "stars" and "isolates" or accept our t_p -scale of interpersonal popularity as denoting a definite trend. If there were no concordance at all, the t_p -values would cluster round the average of 50 and there would be no definite trend apart from chance variations.

Thus, two conditions are required to establish the existence of a trend of

interpersonal popularity: First, the values of W' must be significantly lower than those found in the analysis of the trend of public popularity. Second, the values of W' must be significant either individually or in the aggregate.

In Table VII are shown the values of W' (and their levels of significance) in the secondary and primary rank matrices of inter-personal popularity.

TABLE VII.—*Values of W' in the Rank Matrices of Interpersonal Popularity.*

Group.	Secondary rank matrices.	Primary rank matrices.
Female . . .	.38 ($P = .01$)	.30 ($P = .05$)
Male-female . .	.26 ($P = .05$)	.21 ($P = .10$)
Male . . .	.34 ($P = .002$)	.26 ($P = .02$)
Average $W' = .29$ ($P = .00001$).		

All these W' -values are lower than the three W' -values we reported before in the case of public popularity. The average W' of interpersonal popularity is .29, which is significantly less than the average W' of public popularity, which was found to be .59 ($t = 5.431$, $P = .001$). Thus, our first condition is fulfilled.

The significance of all the individual values of W' in Table VII is, with one exception, at the 5 per cent level or beyond. The one exception has a 10 per cent. significance. In the aggregate the significance of these 6 W' -values is very much greater. To estimate this aggregate significance the method of R. A. Fisher (1948) concerning the "combination of probabilities from tests of significance" has been used. The resulting value of P is approximately .00001.

This fulfils our second condition, and establishes the fact that the scale of interpersonal popularity represents a definite trend within the complex pattern of interpersonal feelings.

Table VII reveals also an unexpected finding. The coefficients W' are consistently higher and of greater significance in the secondary than the primary rank matrices. This finding is the reverse of that in the case of public popularity. A similar difference has been noticed in another interpersonal trend which we are examining at present. The absolute differences have been smaller than those obtained in the case of public popularity. This finding may turn out to be statistically significant, though the reason for it is not clear.

THE VALIDITY OF THE TREND OF INTERPERSONAL POPULARITY.

The validity of this trend depends, in the first place, on the sincerity of the patients' co-operation in the test and their endeavour to rate their feelings correctly. This sincerity can only be impressionistically estimated, but seems to have been of a fairly high order in our group patients.

The motivation of the group members is, however, not the only criterion of the validity of this trend. In their introspective ratings of private feelings the patients are bound to be influenced by the public status of popularity the other group members possess. As stated before, we cannot expect to obtain a pure trend of either interpersonal or public popularity. The two trends will always appear to be positively correlated to some extent.

To be able to attribute some degree of validity to the trend of interpersonal popularity we must therefore be satisfied that this trend is different from that of public popularity. We require, as a minimum criterion of validity, that the correlation between the two trends should be small. It should certainly be significantly lower than the correlation between the t_p -scales of public popularity derived respectively from secondary and primary rank matrices, which was found to be $+.84$.

We obtained, however, a correlation coefficient between the trend of interpersonal and public popularity which was by no means small. It was $+.85$.

We must therefore conclude that, although there is a significant difference between the degree of concordance in the matrices of interpersonal preferences and those of public popularity, the definite trend which emerges from the interpersonal matrices by the additive method used by us is, in its general distribution, identical with the trend of public popularity. Our t_p -scale of interpersonal popularity has no validity as an indicator of private trends of popularity.

This result may be partly due to the particular conditions prevailing in therapeutic groups which hamper the forming of private interpersonal feelings. There is little social mobility in the therapeutic group setting, and the members have scant opportunity of associating with each other privately. In a previous investigation (1950b) of two therapeutic groups which had been under treatment for a long time and in which there had been a good deal of friendly association outside the group situation, only a small and insignificant correlation had been found between interpersonal popularity (then called direct popularity) and public popularity (then called group popularity). We are, however, inclined today to regard that result as largely an artefact which was spuriously caused by the crude methods employed then in assessing the two types of popularity.

We assume that in interpersonal matrices private and public trends of popularity exert a joint influence, and that the additive method by which our t -scales are derived tends to accentuate that trend which is more concordant. In most groups this will be the public trend of popularity. In a later paper we will analyse interpersonal matrices by another method which relies on the differences between scores instead of using their sums. This alternative procedure does not appear to be equally sensitive to the disturbing effect of highly concordant trends.

THE RELATIONSHIP BETWEEN PUBLIC POPULARITY AND PUBLIC DOMINANCE.

Dominance has been operationally defined as the degree of influence a member exercises in the group discussions. This influence is a publicly determined phenomenon which the members were required to estimate objectively by means of the questionnaire and primary ranking test.

The questionnaire item ran: "Do you think he (or she) has a strong influence on the group discussion?" The ranking task was to order the other group members according to the degree to which they appear to dominate and influence the group discussions. The patients were warned not to allow their estimates to be affected by their opinions concerning the merits or demerits of a person's influence.

TABLE VIII.—*Primary Rank Matrix of Public Dominance.*

		M ₁	M ₂	M ₃	M ₄	M ₅	M ₆	M ₇	M ₈	M ₉
M ₁ estimating (in rank order)	.	.	.	.	.	.	.	.	.	.
M ₂	"	I	3	3	3	3	6	3	7	8
M ₃	"	I	.	3	6.5	2	6.5	4	5	8
M ₄	"	I	4.5	.	6.5	2	6.5	3	4.5	8
M ₅	"	I	6	3	.	2	4	5	7	8
M ₆	"	I	7	3	4	.	6	2	5	8
M ₇	"	I	5	3	6	4	.	2	7	8
M ₈	"	I	5	3	4	2	7	.	6	8
M ₉	"	I	3	5	6	2	7	4	.	8
	"	I	4	2	3	8	6	5	7	.
<i>t</i> -scale of group dominance	.	8	37.5	25	39	25	49	28	48.5	64
<i>t_p</i> -scale	"	0.00	52.68	30.36	53.36	30.36	73.21	35.71	72.32	100.00

The test reliability indicated by the (corrected) correlation coefficient between the scores derived, respectively, from the questionnaire and primary ranking test was .92.

For the same reasons as in the case of public popularity the estimates of public dominance have, however, been based exclusively on the ranking test.

Table VIII contains the primary rank matrix of public dominance in our male group, and Table IX the distribution of public dominance in all three groups, expressed as a t_p -scale.

TABLE IX.—*Distribution of Public Dominance.*

Group members*	M ₁	MF ₁	F ₇	MF ₃	F ₄	F ₁
t_p -value	0.00	3.57	20.00	20.24	23.33	25.00
Group members*	M ₃	M ₅	M ₇	MF ₅	F ₂	MF ₈
t_p -value	30.36	30.36	35.71	38.10	40.00	42.86
Group members*	FM ₂	M ₂	M ₄	F ₃	M ₈	M ₆
t_p -value	45.25	52.68	55.36	65.00	72.32	73.21
Group members*	FM ₄	F ₆	FM ₇	FM ₆	F ₅	M ₉
t_p -value	73.81	86.67	86.90	89.29	90.00	100.00

* For the key to the symbols of group membership see Table IV.

The observer reliability was higher than in the case of public popularity. The values of W' were .73 in the female, .79 in the male-female and .77 in the male group. All these values are of high statistical significance. They are also consistently greater than the corresponding values for public popularity, but the numbers are too small to permit a confident deduction that the differences are significant. If further investigation should establish the significance of this finding, it would suggest that public dominance is more conspicuously manifested than public popularity.

The correlation between public popularity and public dominance was found to be + .57. This value is significant beyond the 1 per cent. level of confidence.

This result is in agreement with expectation. It confirms that a leader of a group will tend to be both dominant and popular, whereas a social isolate is relegated to an unpopular and non-dominant position.

The correspondence between popularity and dominance is, however, not too close, and this suggests that some people will deviate from the general tendency and show an unusual discrepancy between their status of dominance and popularity. As such exceptions from the rule are of particular interest, we will examine in greater detail the bivariate distribution of the two group phenomena.

Fig. 1 shows that most of our 24 patients lie very close to the diagonal running from the bottom left-hand corner (popularity and dominance) to the top right-hand corner (unpopularity and non-dominance). There are only three patients whose positions deviate markedly from the diagonal— F_7 , F_3 , and FM_4 . Thus apart from these exceptions, the correlation between popularity and dominance appears to be very close indeed.

F_7 was of high dominance, but low popularity in her group. She was a self-centred, talkative and importunate person. She represents a type of ill-adjusted person whose narcissistic self-concern and aggressive disregard of the feelings of others prompts them to monopolize and exploit the group discussion

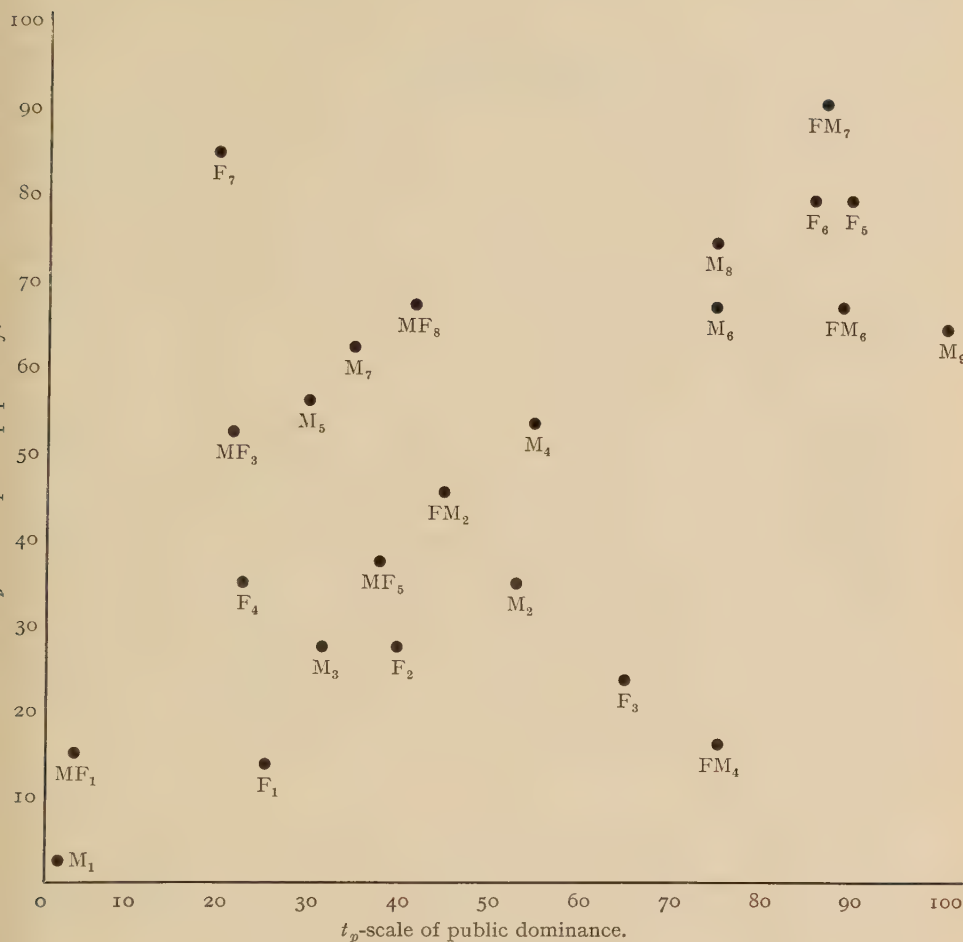


FIG. 1.—Scatter diagram of public popularity and dominance.

for their own gratification. This behaviour earns them general dislike and rejection. They are therefore excessively unpopular in spite of great influence on the group proceedings.

In a previous paper (1950a) it was reported that this type of patient tends to leave the therapeutic group prematurely. F₇ was no exception; she terminated her treatment a few weeks after this investigation had been carried out.

This tendency of dominant, but unpopular patients to discontinue their treatment prematurely does not appear to have been mentioned in the previous literature on group treatment. Indeed, it is easily overlooked, because the patients always advance very plausible reasons for their decision. Yet once this tendency is known, it is possible to predict, with fair accuracy, that these patients will find a pretext for leaving their groups. Such a prediction was actually made in the case of F₇, who belonged to a group not conducted by the author. If it is desired to keep this type of patient in a group, special efforts

by the therapist are called for, who has to point out their peculiar group status and the possible reasons and consequences of it.

A certain, but not so extreme, discrepancy between relatively high dominance and relatively low popularity can, however, occur, not so much as the result of a marked ill-adjustment of personality, but rather as the outcome of a particular group constellation. It has, for instance, been noticed that patients who compete for dominance with an established and accepted group leader tend to lose in group popularity. The relative discrepancy of status caused by this does, however, not seem to drive patients from the group with the same regularity as is the case with the type of aggressively narcissistic patient described above.

F₃ and FM₄ also showed a discrepancy of status which was, however, the reverse to that found in F₇. They were unduly popular compared with their relatively low status of dominance. They, too, represent a particular type of patient whose group behaviour is also based on a narcissistic ill-adjustment of personality. Instead of responding to their narcissistic insecurity by an aggressive self-display, they adopt a different kind of defence. They appear shy and retiring, are rather reticent during group sessions, and make a special effort to please others which often takes the form of adopting an attitude of sympathy and helpful reassurance. This attitude frequently impedes the efforts of the group therapist who tries to encourage self-awareness and frank self-revelation. He may therefore not feel too well disposed towards them, and their unduly high popularity may come as a surprise to him.

INSIGHT INTO OWN STATUS OF PUBLIC DOMINANCE AND POPULARITY.

The scales of public dominance and popularity were derived from ranking tasks in which the patients rated the status of others. The high concordance of their rankings demonstrated that they assessed the status of others from publicly manifested signs which could be objectively perceived.

We may then ask: Do the patients notice these signs, and do they interpret them correctly when they have to assess their own status instead of that of others? That is, are they aware of their own position in the hierarchy of public dominance and popularity?

To obtain an estimate of their self-awareness the patients were asked to judge their own rank of dominance and popularity in the group. They were enjoined to be candid, and not to place themselves—modestly or hopefully—into an average rank position unless they thought that this was correct.

Our aim was to compare these self-assessed scores with the group-scored distribution in order to obtain some indication of the patients' general degree of insight into their own group positions.

The self-assessed scores which each group returned were not consecutive. They were therefore transformed into consecutive rank scales, and each such scale was correlated with a consecutive rank scale derived from the *t*-scores of the group.

The rank correlations between the consecutive rank scales of group-attributed and self-assessed dominance were: + .93 in the female group ($P = .01$),

TABLE X.—*The Formation of Consecutive Rank Scales from t-values and Self-assessed Scores of Public Dominance.*

	M ₁	M ₃	M ₅	M ₇	M ₂	M ₄	M ₆	M ₈	M ₉
t-scale of public dominance	8	25	25	28	37·5	39	48·5	49	64
transformed into rank scale	1	2½	2½	4	5	6	7	8	9
Self-assessed dominance rank	1	3	4	4	4½	3	3	7	8
transformed into rank scale	1	3	5½	5½	7	3	3	8	9

+ ·80 in the male-female group ($P = \text{appr. } \cdot 01$), and + ·65 in the male group ($P = \text{appr. } \cdot 05$). All these correlations are significant individually. The aggregate significance of their combined probabilities attains a very high level of confidence, which is in the neighbourhood of ·0002.

The results indicate that the group members have, in general, fairly good insight into their own status of *public dominance*.

This is in agreement with the assumptions of Polansky, Lippitt and Redl (1950), who inferred from their investigations on small groups of boys and girls that “those children to whom prestige position is attributed are aware of the fact.” Their definition of prestige is related to the degree of influence and dominance individuals exert in their groups. Our results therefore support, by more direct evidence, the assumptions of these authors.

An analogous examination of the insight our patients had into their own status of *public popularity* had a totally different outcome. The rank correlations were — ·05 in the female, + ·71 in the male-female, and + ·31 in the male group. The coefficient found in the male-female group approximates a significance level of 5 per cent., but the other coefficients could have been due to chance. The aggregate of all three coefficients does not attain significance.

It appears therefore that the group members have, in general, only poor insight into their own status of popularity.

This result was not unexpected, as a previous investigation (1950a) had led to the same finding, and other as yet unpublished data are also in agreement with it.

The finding is, however, striking, and requires further consideration. It may be asked: Why should group members have fairly good insight into their own dominance, but only a poor awareness of their own popularity? Why should they succeed, with a fair degree of concordance, in assessing the public popularity of others, but fail in estimating their own?

We stated previously that the dominance and popularity of others is inferred from the overt attitude of the group towards the other members. Yet this attitude is interpreted correctly only as far as their own dominance is concerned; the signs of their own popularity are misinterpreted.

We must therefore assume that a strong emotional bias prevents the group members from accepting the overt evidence of their own popularity.

“FRIENDLY” BIAS.

A scale of “friendly” bias can be derived from the scores of a questionnaire test of interpersonal friendliness, but not from the scores of the corresponding

ranking test. Such a scale, taken from our male group, was shown in the right-hand marginal column of Table I.

The component values of this scale are obtained through summing the scores in each row of a matrix of interpersonal friendliness. It is a self-scored scale because each component value derives exclusively from the introspective self-assessments of a single group member.

This characteristic of self-scoring distinguishes bias scales from the group scored scales with which we have been dealing so far. In fact, we may divide group trends into three different categories :

- (a) publicly determined trends, such as public popularity and dominance ;
- (b) trends which arise out of interpersonal relationships ;
- (c) trends which reflect differences in personality attributes, such as bias scales or the distribution of such variables as age, height, intelligence, temperament, etc.

The original values of the scale of "friendly" bias require corrections corresponding to those we found necessary in the case of interpersonal popularity. In the first place, the potentially distorting influence of the variable status of interpersonal popularity has to be eliminated. This is done by transforming the scores in the columns (not the rows) of the matrix of interpersonal friendliness into secondary rank scores. A t -scale of "friendly" bias is thus obtained which is then made independent of the influence of group size by transformation into a t_p -scale (using a formula equivalent to that given before when the common metric for groups of different size was discussed).

In Table XI this t_p -scale of "friendly" bias is shown.

TABLE XI.—Scale of "Friendly" Bias.

Group members*	F ₂	M ₇	FM ₄	M ₆	F ₆	MF ₅
t_p -value	18.33	25.00	29.76	30.36	31.67	36.90
Group members*	F ₄	M ₉	M ₄	MF ₈	FM ₂	FM ₆
t_p -value	41.67	44.64	47.32	47.62	47.62	47.62
Group members*	F ₁	M ₁	MF ₃	M ₅	F ₇	M ₂
t_p -value	51.67	51.79	53.57	54.46	58.33	58.93
Group members*	M ₃	FM ₇	MF ₁	F ₂	M ₈	F ₅
t_p -value	65.18	67.86	69.05	70.00	72.32	78.33

* For the key to the symbols of group membership see Table IV.

The test reliability of this scale cannot be estimated by the method used in the case of group-scored scales because the primary ranking test does not yield a bias scale. The split-half procedure was therefore employed, using alternate questions. A (corrected) coefficient of .64 was obtained.

It is also possible to apply the coefficient W' for the purpose of evaluating the significance of the scale of "friendly" bias as an indicator of a definite group trend. Of course, this coefficient is here not one of concordance ; on the contrary, it is here a criterion of the consistency with which differential attitudes are adopted by the group members. The following values of W' were found : in the female group .37 ($P = .015$), in the male-female group .17 ($P = .22$), in the male group .23 ($P = .04$). The aggregate significance of the

combined probabilities is .007, which indicates that the t_p -scale of "friendly" bias represents very definite differences in the patients' self-assessments of their friendliness towards the group.

Having thus established that this scale is significant and has a fair degree of test reliability, at least as far as its general trend is concerned, it is our task to form an opinion about the personal attributes and traits which are chiefly reflected by it.

It can be said, in the first place, that the scale of "friendly" bias is not connected with the overt friendliness of the group members. The correlation of this scale with a group-scored estimate (not yet published) of the friendliness of others was found to be zero. The quotation marks qualifying the word friendly are intended to emphasize this point. The friendliness to which the scale refers is, at most, only a desire to feel friendly; but such a desire may conflict with other personal tendencies, and may therefore not manifest itself overtly or only in a modified form.

This is a negative finding, but at present we have hardly any statistical data on which to base a positive opinion about the meaning of the scale. We can, however, formulate some hypotheses, derived largely from clinical impression, concerning the possible validity of the scale.

Clinical impression indicates that the desire to feel friendly towards others is largely determined by irrational motivations. It was found, for instance, that obsessional patients who are disturbed by their own aggressive leanings tend to persuade themselves that they do not dislike any of their fellow group members. Yet their aggressiveness often breaks through their good intentions, and their environment may not therefore consider them to be as friendly as they themselves profess to be.

Other patients with either a high or a low position on this scale are persons who are unduly dependent on the opinion of others. Their self-esteem needs to be bolstered by the appreciation of other people. Such persons will be briefly characterized as narcissistically insecure.

In a mild form, narcissistic insecurity must be regarded as a normal trait which tempers self-centred and inconsiderate personal tendencies. However, when it is present to an excessive degree, it causes neurotic disturbances in interpersonal and public relationships. Such patients have an undue fear of criticism and unpopularity, and are constantly preoccupied with the thought that they might create an unfavourable impression.

Narcissistic insecurity gives rise to various habitual patterns of defensive response. One of these is the desire to feel friendly towards others. It is not a genuine desire, but rather an expectation that professed friendliness will magically induce equivalent feelings in others, or, at least, propitiate the aggressive and critical inclinations of other people. When these magical expectations manifest themselves, in modified form, in overt actions, these are likely to be ingratiating or seductive in manner, even to the extent of personal sacrifice and masochistic suffering. They want to be lovable at any price.

Patients of this kind are often reticent group members. They are afraid to speak, as this might attract potentially critical attention. When they do take

part in group discussions, they frequently offer personal assistance to others in the practical solution of difficulties. They have a strong resistance against the analytical group task of self-revelation, as they fear to forfeit the esteem of the group by the disclosure of embarrassing and guilt-charged facts about themselves.

Their ingratiating and seductive behaviour may succeed in securing them a certain popularity in the group—a popularity which would tend to be out of keeping with their dominance status. It is therefore not surprising that patients F_3 and FM_4 , who stand high on the scale of “friendly” bias, had been noticed previously as deviating from the trend of positive correlation between popularity and dominance through their discrepantly high popularity status.

As far as narcissistic insecurity is concerned the scale of “friendly” bias is U-shaped. Patients at the lowest end of the scale who profess to dislike most group members are also insecure in their self-regard. Their reactive defence pattern against this insecurity is, however, not one of ingratiation; on the contrary, they try to defend themselves by pretending emotional independence from the feelings of others. Left to themselves, such patients would withdraw from social contact, but when they are forced to meet other people, as in the therapeutic group situation, they are not necessarily very aloof. Their overt behaviour may even be such that they attain a high status of dominance and popularity in spite of their professed unfriendliness. An example of this kind is patient M_3 . A more striking illustration was provided by a patient whose group status and neurotic difficulties were described in a previous paper (1950a). He was the leader of the group in both dominance and popularity, was generally considered to be the most friendly group member, and yet was so low on the scale of “friendly” bias that only one member (F_5) of our present groups had an even more extremely low position.

We may therefore put forward the hypothesis that two of the factors which will be found to be related to the scale of “friendly” bias will be, first, obsessional fears of one's own aggressiveness, and second, narcissistic insecurity with its divergent defensive reaction formation in the sphere of dereistic thought.

The correlations of the scale of “friendly” bias with the trends of public dominance and popularity were near to zero. However, it was noticed that, as far as popularity was concerned, this result could be an artefact due to the mingling of data from male and female patients. If the correlations of “friendly” bias and public popularity are calculated separately for the 11 women and 13 men in our groups, we obtain a coefficient of + .44 for the women and — .33 for the men.

The correlated populations are too small in this case to confer significance to either of these coefficients, but the difference between them is significant between the 10 and 5 per cent. level of confidence. The examination of other therapeutic groups which we have been able to carry out so far seems to support the significance of this difference between the attitudes of men and women. If further investigations should substantiate this finding, it would indicate (a) that the choice of popularity is weighted in favour of different types of personality in men and women, and (b) that men and women respond differently to the perceived, though misinterpreted signs of their own popularity in the group.

SUMMARY.

Certain psycho-social trends have been examined in three analytically conducted therapeutic groups by means of questionnaire and/or ranking tests given to the group patients. The patients were required to estimate, by introspective or objective observation, either their own feelings or phenomena exhibited by others.

The scores of the patients' estimates were arranged in matrix form. From these matrices three types of group trends could be derived by means of an additive procedure :

- (a) Public trends arising out of the overt behaviour of the patients in their role as group members. Two such trends were examined—public popularity and public dominance.
- (b) Interpersonal trends which emerge from the sociometric network of person-to-person relationships. The trend examined was termed interpersonal popularity.
- (c) Personal trends indicating the distribution of certain interpersonal traits among the various group members. The trend examined was termed "friendly" bias.

Methods have been described of correcting the trend scores in order to eliminate some of the distortions caused by other intra-group influences and by the inter-group differences of size of membership. In this way it was possible to form aggregate group trends comprising the members of all three groups.

The test reliabilities of the various group trends were assessed. The reliability coefficients were : $\cdot 91$ for public popularity, $\cdot 92$ for public dominance, $\cdot 95$ for interpersonal popularity, and $\cdot 64$ for "friendly" bias.

The observer reliability for trends based on introspective observation (interpersonal popularity and "friendly" bias) depended on the sincerity of the patients' co-operation, which was judged to have been of a fairly satisfactory order.

To estimate the observer reliability and validity for trends based on objective observation (public popularity and public dominance) a coefficient W' was introduced which was modelled on Kendall's coefficient W of concordance. The average coefficients W' for our three groups were $\cdot 59$ for public popularity and $\cdot 76$ for public dominance. These values were accepted as satisfactory as far as the general distribution of the trends was concerned, but not with regard to the validity of the status of individual patients. Occasionally, however, it is possible to attribute fairly high validity to the status of individual patients at either extreme of the trends of public popularity and dominance.

In the scales of interpersonal popularity the average coefficient W' was, as expected, significantly lower, and was found to be $\cdot 29$. This value was, however, still significant, indicating thereby that the aggregate scale of interpersonal popularity reflected a definite group trend.

Applied to the personal group trend of "friendly" bias the coefficient W' is not a criterion of concordance, but one of consistency with which differential attitudes are adopted by the group members. The average coefficient W' was

also highly significant, and therefore indicated definite differences in personal attitudes.

The scales of the two public trends could be accepted as fairly valid estimates of the general distribution of popularity and dominance in the groups.

The scale of interpersonal popularity was found not to be valid because of its high correlation with public popularity. This suggested that the patients, in assessing their friendliness towards fellow group members, were influenced by the status of public popularity the other members had achieved. It also showed that the additive procedure by which the scale of interpersonal popularity was derived accentuated the more concordant public trend.

The scale of "friendly" bias is "self-scored" in contrast to the "group-scored" scales of public and interpersonal trends; that is, each component value of the scale is derived from the scores of a single patient only. The scale has no validity as an indicator of overt friendliness; it refers to derisive desires rather than exhibited attitudes. The hypothesis was advanced that the scale will be found to be related to two neurotic tendencies—obsessional fear of one's own aggressiveness, and narcissistic insecurity giving rise to desires of either ingratiation or emotional independence.

The correlation between public popularity and dominance was $+ .57$. Some patients deviated conspicuously from this general correlation trend. It was noticed that, among these deviant patients, those who had a discrepantly high dominance position were likely to terminate their group treatment prematurely. Deviant patients, on the other hand, whose popularity was discrepantly high were likely to belong to the type of narcissistically insecure person with reactive desires for ingratiation, i.e., to stand high on the scale of "friendly" bias.

Insight into one's own status of dominance and popularity was also examined. It seems that, in general, patients are fairly well aware of their dominance in the group, but not of their popularity. This poor insight into one's popularity is assumed to be apparent rather than real. Patients are bound to notice the overt signs in the attitude of the group which indicate the popularity not only of others but also of themselves. In their own cases the patients, however, misinterpret the overt signs.

The correlation between "friendly" bias and public popularity may be different in the two sexes, being negative in men and positive in women. This significance of this finding is, however, not fully established yet.

REFERENCES.

- FESTINGER, L., "The Analysis of Sociograms Using Matrix Algebra," *Human Relations*, 1949, **2**, 153-158.
 FISHER, R. A., *Statistical Methods for Research Workers*, 1948. Edinburgh and London: Oliver and Boyd. Pp. 354.
 FORSYTH, E., and KATZ, L., "A Matrix Approach to the Analysis of Sociometric Data," *Sociometry*, 1946, **9**, 340-347.
 FOULKES, S. H., *Introduction to Group-Analytic Psychotherapy*, 1948. London: William Heinemann Medical Books. Pp. 181.
 JENNINGS, H. H., *Sociometry of Leadership: Based on the Differentiation of Psychogroups and Sociogroups*, 1947. New York: Sociometry Monographs, No. 14. Pp. 28.
 KATZ, L., "On the Matrix Analysis of Sociometric Data," *Sociometry*, 1947, **10**, 233-241.
 KENDALL, M. G., *Rank Correlation Methods*, 1948. London: Charles Griffin. Pp. 160.

- LEWIN, K., LIPPITT, R., and WHITE, R. K., "Patterns of Aggressive Behaviour in Experimentally Created Social Climates," *J. Soc. Psychol.*, 1939, **10**, 271-299.
- LUCE, R. D., and PERRY, A. D., "A Method of Matrix Analysis of Group Structure," *Psychometrika*, 1949, **14**, 95-116.
- MORENO, J. L., *Who Shall Survive* :, 1934. Washington : Nerv. and Ment. Dis. Publishing Co. Pp. 440.
- Idem*, "Sociogram and Sociomatrix," *Sociometry*, 1946, **9**, 348-349.
- POLANSKY, N., LIPPITT, R., and REDL, F., "An Investigation of Behavioural Contagion in Groups," *Human Relations*, 1950, **3**, 319-348.
- TAYLOR, F. KRÄUPL, "The Pattern of Friendliness and Dominance in a Therapeutic Group," *J. Ment. Sci.*, 1950a, **96**, 407-425.
- Idem*, "The Therapeutic Factors of Group-Analytical Treatment," *ibid.*, 1950b, **96**, 967-997.
-

CYTOCHROME C IN SENILE AND ARTERIOSCLEROTIC DEMENTIA.

By W. FORSTER, M.B., B.S., D.P.M.,
Senior Registrar, Middlewood Hospital, Sheffield,

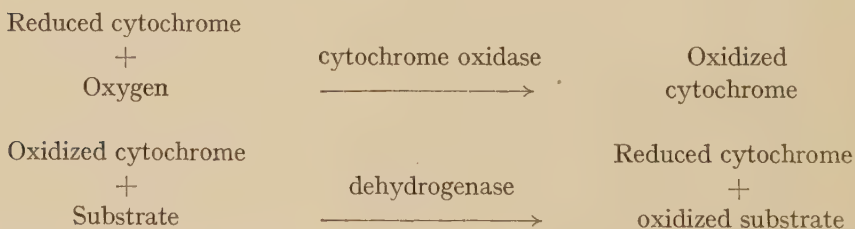
and

E. J. G. BRADFORD, M.Sc.,
Senior Lecturer in Education, Sheffield University; Psychologist, Middlewood Hospital.

INTRODUCTION.

CYTOCHROME, an intracellular enzyme widely distributed in all oxygen-using tissues, consists of a mixture of three haemochromogen-like substances referred to as a, b, and c. Of these cytochrome c has been isolated and is available commercially. In living cells cytochrome can be seen spectroscopically to be undergoing alternate oxidation and reduction. It plays an important part in tissue respiration, the respiratory activity of a cell being indeed proportional to its cytochrome content.

The chemical role of cytochrome c is not well understood. It exists in oxidized and reduced forms, and the reduced form is not auto-oxidizable. In the tissues its oxidation is catalyzed by indophenol oxidase (cytochrome oxidase), and the oxidized form is reduced by dehydrogenases. Probably it acts as an intermediary in the transfer of oxygen to oxidizable substances within the cell, its mode of action being that of alternate oxidation and reduction. The action can be shown in a simplified form as :



Proger and others (1945*a*) showed that the cytochrome c content of organs can be increased by its parental administration. The added amount so produced is sufficient *in vitro* to cause an increase of tissue oxygen consumption of 50 to 100 per cent. The normal cytochrome c content of organs is far below that required for the maximal activity of the cytochrome oxidase.

The therapeutic application of cytochrome c has been suggested by its ability to prevent certain effects of experimental anoxia. Thus Proger and Dekaneas (1946) showed that it prevented the effects of anoxia on the electro-

cardiogram. Their patients under experiment also found that they could tolerate the subjective effects of oxygen lack more easily. In the same paper the authors report on two subjects in whom it prevented certain measurable effects of cerebral anoxia, namely the impairment of visual discrimination and the slowing of the cerebral functions used in code transliteration. Proger and others (1945*b*) showed that in the tissues anoxia produces a sharp reduction in the easily hydrolysable phosphorus fraction, which can largely be prevented by the previous administration of cytochrome c. Proger (1945) states that under anoxic conditions injected cytochrome c decreases in the blood and increases in the organs. Normally it is not present in the circulating blood.

Howe and Mellors (1945) found a reduction in cytochrome oxidase activity in neurones of the thalamus and anterior horn regenerating after injury. This also leads to speculation as to the possible therapeutic application of cytochrome c.

Therapeutically the enzyme has been given for the muscle ischaemia of intermittent claudication, in which it has been followed by improvement; but no beneficial results have been seen in coronary occlusion and myocardial infarction.

PSYCHIATRIC APPLICATION.

The work of Garnett and Klingmann (1950) is of more interest to psychiatrists. After a detailed survey of the theoretical and experimental basis they record the effects of intravenous cytochrome c in 17 cases of early senile, presenile and arteriosclerotic states. Clinical improvement during and after administration was thought to occur in 11, 4 improving only during the course of treatment, the remainder showing some degree of sustained improved function. The improvement was seen in the early senile and arteriosclerotic types as opposed to those with a large "functional" element in the disease picture, or in whom psychological conflicts were prominent. Improvement was seen in regard to "memory, orientation, irritability, interest, confusion and behavior." There were no definite effects on the E.E.G. Psychometric tests carried out on 11, using the Wechsler Bellevue forms 1 and 2 before and after therapy respectively, showed no significant difference in the test scores; but in every case the second examination showed "qualitative improvement, such as increased speed of response, increased alertness, decreased confusion, greater ability to comply with instructions, greater ability to verbalize, and more relaxed behaviour." Control experiments were not performed, but the changes during the trial period are generally contrasted with those in 27 senile reactions treated non-specifically by the authors during the previous three years. They make no claims, but "feel encouraged . . . by the clinical changes noted during the short observation period."

The process of dementia is irreversible once well started. On the other hand, the importance of social and other environmental factors in the breakdowns of the elderly is now more fully appreciated, and caution is necessary in early cases if a too hasty over-estimation of the degree of permanent cerebral damage is to be avoided. In our experience of mental hospital admissions, however, marked improvement is most likely to be seen only in those under-

going a transient confusional episode. Other cases not running a rapid course of progressive dementia frequently make some improvement when given adequate care and a programme designed to prevent apathy and stimulate social activity. In the latter type the improvement is seen in the behaviour to an environment suited to the needs of the patient rather than in any true increase of "intelligent" response, though there is frequently some recapturing of previously well-established habits.

Thus any drug therapy which does not produce more than slight improvement must be difficult to evaluate. We were, however, interested in the report of Garnett and Klingmann, and thought the experiment worth repeating with fuller case data and with controls.

THE INVESTIGATION.

At the outset, 10 female patients were treated by 9 daily intravenous injections of cytochrome c, controlled by 10 similar cases given 9 daily injections of 5 ml. normal saline. The solutions were distinguished by letters, the nursing staff, who reported daily on each patient, being told that both were vitamin solutions under comparison. Psychometric tests were carried out before treatment, and the same tests repeated within a fortnight of its cessation, the psychologist (E. J. G. B.) being unaware at the time of testing as to which solution the patient had received. Psychiatric examinations were carried out before and within a week after cessation of treatment, as well as day-to-day observation.

Subsequently one patient had to be discarded from the treated group owing to an intercurrent illness interfering with assessment of results. A control case was also discarded. In assessing the results of psychometric testing a further patient was discarded from each group, their scores being too equivocal for use. The clinical results in these are reported.

Details of cases and controls and the clinical and psychometric results are given in Table I. Details of dosage are given in Table II.

No untoward effects were seen during the course. Cytochrome c would seem to be non-toxic, as indicated by Proger (1945), but it has been shown by Roth and others (1949) to be antigenic in animals, and hence an intradermal test was done on each patient prior to the course.

PSYCHOMETRIC TESTS.

(1) *Peg board*.—This test provided two scores, firstly for the time taken in removing wooden pegs from a tin on one at a time and inserting them into holes in a board; secondly for the time taken in replacing the pegs one at a time in the tin. The first operation requires greater precision of movement than the second. The test was attempted first with the right hand and then with the left.

(2) *Coloured peg board*.—A single score was obtained by subtracting the number of wrongly placed pegs from those correctly placed. The pegs were of 3 colours, and the top surface of the board was divided up into squares of the same 3 colours: yellow, red, and brown. As most patients tended to

TABLE I.—*Details of Cases and Results of Treatment.*

1a-9a treated. 1b-9b controls.

Case.	Diagnosis.	Total duration (years).	Present age.	Affect.	Delusions.	Degree of dementia.	Pegs in.	Pegs out.	Pegs coloured.	Similarities.	Repetition.	Kohs.	Form boards.	Total gain on last 4 tests.	Objective clinical improvement.
1a	SD	$1\frac{7}{8}$	77	D	DP	a	o	o	o	—	o	—	+	—1	Nil.
2a	AD	5	70	I	P	b	+	+	+	+	—	—	+	+1	„
3a	SD	$1\frac{3}{8}$	76	E	P	b	+	+	o	o	o	o	o	o	„
4a	AD	$4\frac{1}{2}$	72	D	D	b	+	+	o	+	+	+	—	+1	„
5a	SD	10	72	L	P	b	—	—	o	+	+	+	o	+2	„
6a	SD	3	80	D	DP	a	—	o	o	+	+	+	o	+3	Slight.
7a	SD	2	76	D	D	a	o	o	o	+	o	+	o	+2	„
8a	SD	8	76	D	D	a	o	+	+	—	—	+	+	o	Nil.
9a	AD	4	81	E	—	c	—	—	—	—	—	—	—	—	„
1b	SD	3	71	D	DP	a	+	+	+	+	—	—	—	—2	„
2b	AD	$2\frac{1}{2}$	71	A	P	a	o	o	o	+	—	—	+	o	„
3b	SD	1+	73	E	—	c	+	+	+	—	+	o	o	o	Slight.
4b	SD	7	72	N	G	b	o	o	—	—	o	—	—	—2	Nil.
5b	SD	$4\frac{1}{2}$	72	D	D	a	+	o	o	+	—	+	+	+2	„
6b	SD	4	75	I	—	b	+	o	+	—	—	+	o	—1	„
7b	AD	2	79	D	P	a	+	+	+	+	—	+	—	o	Slight.
8b	SD	$6\frac{1}{2}$	80	D	DP	b	—	o	o	—	—	+	+	o	Nil.
9b	AD	7	60	E	—	c	—	—	—	—	—	—	—	—	„

3a did not attempt the first peg board; 5a was nearly blind and could only find the holes in the board by touch, this defect being also a handicap in the Kohs and form board tests.

Key.—SD = senile dementia. AD = arteriosclerotic dementia. D = depressed. E = euphoric. G = grandiose. I = irritable. L = labile. P = paranoid. a = slight. b = moderate. c = marked.

TABLE II.—*Dosage of Cytochrome C Intravenously.*

Case.	No. injections (once daily) and dosage.	Case.	No. injections (once daily) and dosage.
1a	9 of 50 mgm. each	6a	10 of 50 mgm.
2a	„ „	7a	9 of 50 mgm. each.
4a	„ „	8a	„ „
4a	„ „	9a	6 of 50 mgm., 3 of 25 mgm.
5a	5 of 50 mgm., 4 of 25 mgm.		

confuse the reds with the browns these two colours were treated as one, and the problem became one of responding to the difference of 2 colours. A maximum time of 2 minutes was allowed for each attempt. The 24 pegs consisted of 10 yellow, 10 red, and 4 brown.

(3) Kohs blocks.—Only 2 of the simpler 4-block patterns were used, the 0 and 1 (Bradford, 1943). The building of the pattern was demonstrated up to 4 times, and after each the subject was allowed one minute for an attempt to construct the pattern. For the second pattern the subject was allowed to make the first attempt before any demonstration. This was followed by up to 3 demonstrations, each followed by an attempt. The maximum of 4 points for a correct solution at the first attempt was reduced by 1 for each

failure within the 1-minute time allowance. Hence speed cannot be regarded as of great importance in this form of the test.

(4) *Similarities* (Terman and Merrill).—The series appropriate to the ages of 6, 8 and 11 years were amalgamated. A point was scored for each correct likeness and for each correct difference, thus allowing a maximum score of 17.

(5) *Repetitions* (Bradford, 1943).—A graded series of phrases and sentences, increasing from 3 words to 7 words, was vocalized by the tester at the rate of one word per second: (a) the subject required to repeat the same words; (b) the series was vocalized a second time and the subject was required to say the words both in the forwards direction and in the reverse direction, e.g., "stale, brown, bread: bread, brown, stale."

(6) *Form boards*.—The 3 boards used were the triangles, the diagonal, and the Healy A, as described by McGaw. They were scored differentially for success in 50, 100, or 150 seconds.

THE RESULTS OF TESTING.

These are summarized in Table I. Since the two groups had been roughly equated in regard to age, clinical diagnosis, and the suggestive effect of similar treatment, and since the tester was in ignorance of the treatment received, it may reasonably be assumed that any measurable differences in test scores before and after treatment are due to the treatment given.

The differences between the two groups when measured by "t" were not significant at the 5 per cent. level.

The calculation of "t" for the individual tests was based upon the raw scores, but for the combined battery it was based upon the total gains and losses, it being difficult to arrive at a satisfactory common scale for the different tests when applied to such a small sample. It is debatable whether the effect of treatment should be judged by the size of the gain in the individual test score or by the number of tests in which a gain is shown. In so far as the tests measure separate abilities such as verbal or spatial, probably the latter alternative is preferable as a measure of change in general ability. The number of gains derived from the peg board tests favours the control group, but the difference between the two groups obtained from the battery of the remaining 4 tests, though suggesting a possible trend in favour of the treated group, hardly encourages any great hope that an experiment planned on a larger scale would be conclusive.

DISCUSSION.

It is unnecessary to stress the dangers in drawing conclusions from a small series such as this, and there are difficulties in getting parallel control cases, since each case is essentially an individual deviation from an individual norm even when the diagnostic category is plain. Every case, however, showed a greater or lesser degree of dementia. Though the groups were reasonably comparable, this absence of absolute parallelism, considering the small numbers involved, could lead to erroneous conclusions.

Clinical improvement occurred in two cases in each group. In all of these

it was slight, and seen as increased activity and interest in the environment with improvement in mood. Almost all the treated and control cases showed a more alert, relaxed and friendly approach to the second psychometric examination, probably the result of familiarity with the psychologist and his procedure.

Most of our cases could not be classed as early. Where cases are really early, within the first three months as Beckenstein and Gold (1945) indicate, there is always the possibility of spontaneous improvement. Our material differed thus from Garnett and Klingmann's; but in a number of our cases the dementia was only mild, and in 1a and 3a, where the illness was of short duration following a rapid onset treatment produced no improvement at all. On the other hand, in the treated group the improved cases had been ill 3 years and 2 years, in the control 2 years and 1 year plus. Even early cases must have some permanent organic changes, and the earliness may be an indication for prognostic caution but does not necessarily give a guide to treatment prognosis.

Conclusions based upon the psychometric testing of aged persons must of necessity be tentative until such time as batteries of tests have been devised which will adequately differentiate the residue of their failing capacities. Added to this limitation is the more serious one of the subjects' lack of interest in the objective world, which in the test situation can be overcome only by efforts of persuasion on the part of the tester aimed at maintaining attention and obtaining appropriate response from the subject. For a single tester such efforts can hardly be standardized from time to time nor from subject to subject, still less for different testers.

Thus a test response will frequently be a measure of the relation of the persuasive powers of the tester to the resistance of the subject, as much as a measure of the efficiency of the subject in dealing with the test situation. The young are as likely to be interested in the novelty of the test situation as the aged are to be disturbed or irritated by this novelty. The differentiation between conative and cognitive functions, which is frequently overlooked when testing the young, becomes a matter of very considerable importance in testing the intellectual capacity of the aged. The problems relevant to the testing of senile persons have been thoroughly described by Jones and Kaplan (1945). but since a more refined statistical technique has been applied to the data from this investigation, we consider it advisable to draw attention to these problems afresh, since no improvement of statistical technique can eliminate the consequences of experimental errors.

SUMMARY.

(1) 9 cases of senile and arteriosclerotic dementia were treated by 9 daily injections of cytochrome c, controlled by 9 similar cases receiving normal saline.

(2) It was not possible to demonstrate any significant improvement of the treated group over the controls with the dosage employed, whether by daily observation of behaviour, psychiatric examination or psychometric testing.

We wish to thank Dr. F. T. Thorpe, Medical Superintendent, Middlewood Hospital, for facilities for this investigation, and Messrs. Evans, Medical Supplies Ltd., for their generous supply of "Landrax," the preparation of cytochrome c used.

REFERENCES.

- BECKENSTEIN, N., and GOLD, L., *Psychiat. Quart.*, 1945, **19**, 398.
 BRADFORD, E. J. G., *B. J. Med. Psych.*, 1943, **19**, 414.
 GARNETT, R. W., and KLINGMANN, W. O., *Am. J. Psychiat.*, 1950, **106**, 697.
 HOWE, H. A., and MELLORS, R. C., *J. Exp. Med.*, 1945, **81**, 489.
 JONES, H. E., and KAPLAN, O. J., Chap. 4 in *Mental Disorders in Later Life*, 1945. Ed. Kaplan. Stanford U.P., Oxford U.P.
 PROGER, S., *Bull. New England Med. Center*, 1945, **7**, 1.
Idem and DEKANEAS, D., *J. Pediat.*, 1946, **29**, 729.
Idem, and SCHMIDT, G.,
 (a) *J. Clin. Invest.*, 1945, **24**, 864.
 (b) *J. Biol. Chem.*, 1945, **160**, 233.
 MACGAW, Industrial Fatigue Research Board, pamphlet No. 31.
 ROTH, L. W., RICHARDS, R. K., and SHEPPERD, I. M., *Proc. Soc. Exp. Biol. and Med.*, 1949, **70**, 116.
-

STUDIES IN LEARNING IMPAIRMENT. I: SCHIZOPHRENIC AND ORGANIC PATIENTS.

By K. R. L. HALL, M.A., D.Phil., and T. G. CROOKES, M.A.,

Department of Psychology, Bristol Mental Hospitals.

ABILITY to learn and retain relatively unfamiliar materials has been shown to be impaired in many clinical syndromes, both organic and functional. The testing of this ability features in some form or other in several clinical tests of intelligence, such as the Wechsler Scale and the Binet, while it is more directly tested in the various memory scales. As is well known, efficiency of learning declines with age, and can be greatly reduced by organic brain damage. There is evidence also, which we shall briefly review, that it can be variably reduced in schizophrenia and in psychoneurosis.

With regard to impairment in schizophrenia, Gardner (1931) believed that schizophrenics show even *prepsychotically* an inferior learning ability when compared with a like number of manic-depressive patients. He found that schizophrenics, before the onset of the psychosis, do not go as high in grade status in school as the manic-depressives. In this study, however, the comparative school *attainment* of a schizophrenic group is evaluated in an unreliable way, and whether or not this finding should be more accurately confirmed, it has little more significance than to suggest a predisposition to impairment, which becomes more obvious in the later clinical setting.

A recent study by Huston and Shakow (1949) puts the problem on a sounder experimental basis. They used two learning tasks. The first consisted of pursuit-learning, and this required a progressive acquisition of skill in following a rotating target. The second was a similar motor skill test, in which a turntable revolved only when the patient kept a pointer on the target, so that the measure of learning achievement was given by the time taken for the turntable to revolve a fixed number of times. The writers found that, even with those schizophrenics rated as fully co-operative, there was a significant reduction in learning achievement when the group was compared with a normal control group. They found also that, with repeated retesting, some schizophrenics were able to reach perfect performance, and this led the writers to conclude that *capacity* to learn is unimpaired, and that it is a functional interference which so much reduces the schizophrenic performance below the normal. This impairment, they point out, makes the rehabilitation and re-education of the schizophrenic particularly difficult, but, conversely, it also suggests that adequate learning tasks may have some prognostic value.

As to learning efficiency in the psychoneurotic, several writers have drawn attention to distinctive qualities of failure which are of some interest. Trist (1941), using the Rey performance test, observed that the rotation of the

peg-boards upset the neurotics so that they tended to spoil their performance. Zangwill (1943, 1946), using three short tests (including the Rey) as an indicator of memory impairment, observed that patients with anxiety states or hysterical reactions seemed to give characteristic reactions on these tests. Neurotic performance was apt to be highly variable and inconsistent. On the Rey itself, he found learning to be not infrequently slow and showing occasionally stereotyped patterns of error, while some cases showed peculiarities of tempo and procedure. From the nature of the test, differences between the failure of neurotics and that of uncomplicated organic cases could only be observed qualitatively, but the writer concluded that Rey's test, with a procedure modified by Davis of Cambridge, could prove helpful in the differential diagnosis of organic and psychogenic disorders of memory. Davis himself (unpublished communication, 1950) used the test on psychoneurotics, and some of his cases he found to come very near success and then to make an extravagant number of mistakes again.

As to the actual tests used in the previous work, the Rey has undoubted value, but has been found unreliable in patients of high intelligence. Even though moves and time are recorded carefully, the value of the test depends primarily upon the qualitative grasp and experience of the individual examiner. Zangwill (1943) concludes regarding the use of his three short tests (repetition of digits, Babcock sentence repetition, and the Rey) that "the learning defect as displayed in these simple experimental settings appears sufficiently constant and uniform to justify further research and eventual standardization of appropriate tests."

In designing the present investigation, therefore, we have borne in mind both the value of the qualitative observations that good clinical tests can provide, and the need to make our estimate of learning efficiency more objective with regard to the obvious factors of age and intelligence level. Huston's and Shakow's study and Babcock's tests (1940) have demonstrated different methods of assessing the degree of learning impairment in schizophrenia, while Zangwill's tests have indicated that it should be possible to measure more objectively the kinds of failure in psychoneurotics. We can summarize the objects of our study as a whole as—(1) to set up suitable learning tasks which will provide an objective measure of progress in learning, as well as indicating in easily recordable form some of the distinctive features of schizophrenic and psychoneurotic failure, and (2) compare the performance of normal subjects on these tasks. In the present paper we shall give the results only for the schizophrenic and organic patients, as the preliminary results on the psychoneurotic group seemed to warrant separate treatment and a more extensive survey.

LEARNING TASKS AND PROCEDURE.

The two learning tasks were :

(1) *Word-pair Learning.*

This consists of 10 sets of word-pairs which could be classed as "hard," in the sense used by Wechsler that the learning of them requires the forming

of a new and unfamiliar connection. The pairs of words are : (1) old—easy ; (2) thought—comfort ; (3) captain—train ; (4) care—sleep ; (5) monkey—bird ; (6) story—change ; (7) desert—table ; (8) general—small ; (9) time—money ; (10) storm—chance.

These 10 pairs are read out aloud slowly one by one in the same order, with a short pause between each pair. The subject is told to listen carefully to the pairs of words as they are read out, and to try and remember them so that when the *first* word only of each pair is given to him, he will be able to recall the word that went with it. The subject is told whether his answer is right or wrong, but no further help is given him. The list is then read out again up to a maximum of 10 repetitions, or until the subject has correctly recalled all 10 pairs in a particular series. If a subject makes a wrong answer but corrects himself quickly, this is counted as right. If he gets the word right *after* the examiner has told him wrong, that is counted as wrong.

(2) *Performace Task—Switch Learning.*

Apparatus.—This was contained in a box. In the centre of the top of the box stood a small 6-volt bulb. Also on top of the box were 3 double pole, double throw toggle switches. These were the subject's switches. At the other end of the box was another row of three similar switches. These were the experimenter's switches. The lay-out is shown in Fig. 1 below.

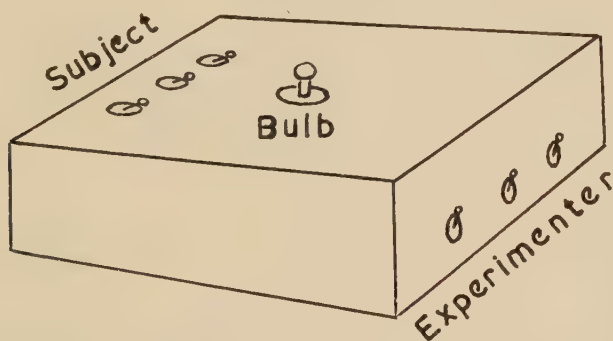


FIG. 1.—Diagram of switch-learning apparatus.

A battery inside the box was wired to the bulb through all the switches in such a way that the circuit was completed when, and only when, all the switches at one end were in the same position, up or down, as those at the other. Thus, in whatever position the experimenter set his switches, the subject had to put his switches in the same position to make the light come on. The movements made by the experimenter were partially concealed from the subject by the depth of the box, but, to prevent the subject from taking cues from these movements, the experimenter's switches were placed in a different order from those of the subject.

The spare connections of the subject's switches were wired through a separate battery, one to each coil of a Palmer 3-pen chronograph, in such a way that when the switch was in the "down" position the coil was activated,

and in the "up" position the circuit was broken. Thus, a record was made of all movements of the switches, and the time at which they occurred.

Procedure.—The subject had to learn 5 combinations of switches, chosen arbitrarily. The order of the 5 positions was the same in each trial, and he was allowed up to 10 trials to learn to switch all 5 on without any superfluous moves. He started always with all 3 switches up, and the minimum number of moves for a whole trial was 8. When a perfect score was made in a trial before the 10th, he was asked to go through them again to make sure he had learned them securely.

In the first trial the 5 positions had to be found by trial and error. The subject was seated at his end of the box, with the experimenter opposite. Instructions were given in these words:

"I want you to learn some combinations of switches. These are 3 ordinary switches, with just two positions—up and down (*demonstrating*)—and when all 3 are in a certain position this light will come on. When we start, I want you to move the switches until the light comes on, then remember the position for next time. I shall then alter the combination, and get you to find another one, and so on for 5 different combinations. The first time you will have to do it by trial and error; then remember them so that you can switch them straight on next time. We shall go through them until you can switch all 5 on at once, with no extra moves. Remember it is not the order in which you switch them on that matters, but only their final position."

The experimenter then set the first combination. Each time the light was switched on, the experimenter first set the next combination on his own switches, then put the subject's switches in the "up" position, making an interval of as nearly as possible 5 seconds between the light going on and the switches being replaced.

RESULTS.

I. *Comparison of Normal and Schizophrenic Performance.*

(1) *Word-pair Learning.*

The schizophrenic group consists of 35 patients, mainly early acute cases, and does not include any designated as markedly paranoid in symptoms, nor does it include any patients who failed to co-operate on the tasks. The age range is from 17 to 41, with the majority of cases falling within the 20–30-year age-group. As some criterion of prepsychotic attainment, the raw score on the Wechsler adult intelligence scale vocabulary test has been used, and, for the group, this ranges from 16½ to 40, the majority falling within 20 and 30.

The normal group consists of 32 subjects, the distribution of age and vocabulary level corresponding very closely with that of the schizophrenic group, although the normals are slightly higher on vocabulary but also slightly older than the schizophrenics.

Results for the two groups are shown in Fig. 2 below, in which the average number of word-pairs correctly recalled on each of 10 trials is given.

As a group, the schizophrenics appear considerably worse than the normals on this task, and this is perhaps brought out more clearly in Fig. 3, where the

same results are given in the form of histograms which show the number of subjects in each group who reached a perfect score of all 10 word-pairs correctly recalled on each of the 10 trials.

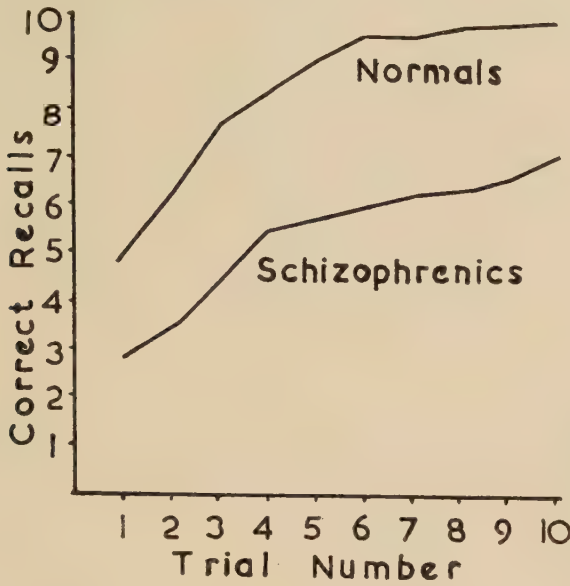


FIG. 2.—Graphs showing word-pair learning of normals and schizophrenics.

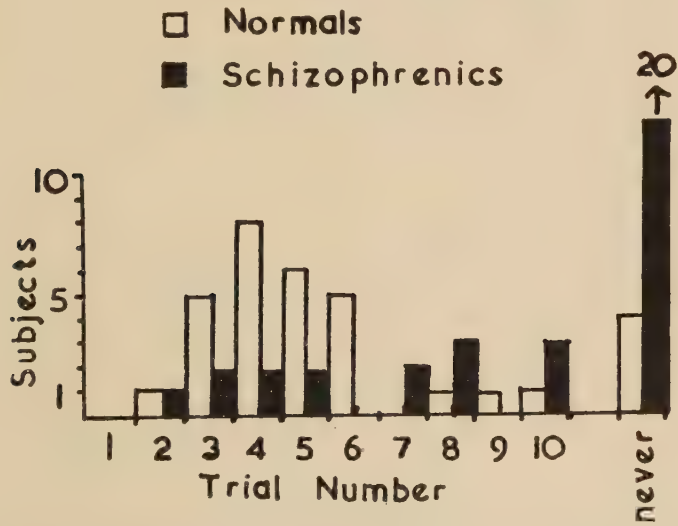


FIG. 3.—Histograms showing number of subjects in the two groups reaching perfect performance at each trial on the word-pair learning.

It will be seen that, whereas only 12.5 per cent. of the normals fail to reach perfect recall on the 10th trial, 57.1 per cent. of the schizophrenics fail to achieve the maximum number. Within the group the schizophrenics show considerably more variation than the normals. Some of the best schizophrenic patients

are quite as good on the tests as the best of the normals, but whereas no normal scored less than 9 on the tenth trial, one schizophrenic scored 0, and 14 had scores of 6 or fewer. There is no doubt that most of the schizophrenics make some progress, but they often start lower and remain lower in their learning curve throughout the trials. Individually, also, the schizophrenics tend to be much less *consistent* in their learning progress than the normals, 27 of them (77 per cent.) having at least one relapse, i.e., scoring less on one trial than on the preceding trial, whereas only 8 normals (25 per cent.) ever dropped below their previous score. In some cases the schizophrenics seem to have difficulty in overcoming what appears to be an interference from their own associations to the stimulus words as they are given out by the experimenter. This may at least in part account for the much slower learning that is observed in a number of the patients. The quality of the impairment will be made clearer when we examine the individual variations within the group.

(2) *Switch Learning.*

The same 35 schizophrenic patients carried out this task as for the word-pairs. The normal group consists of 26 subjects, of comparable age and vocabulary distribution. Results for the two groups on this task are given in Fig. 4 below, in which the average number of moves required at each trial for the total of 5 switch combinations is shown.

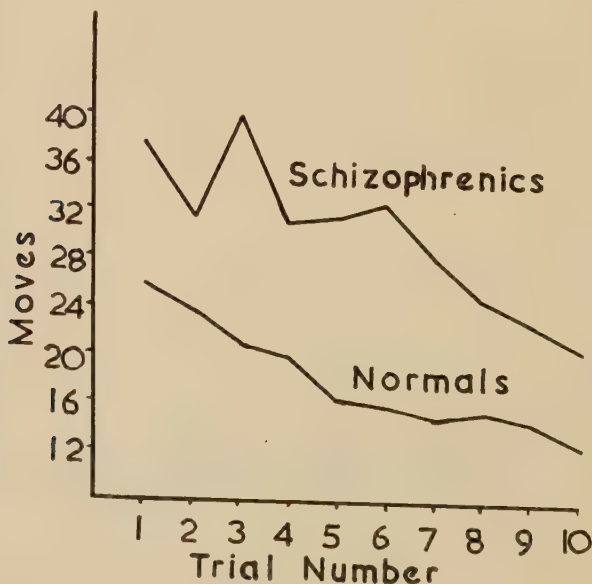


FIG. 4.—Graphs showing switch-learning performance of the normal and schizophrenic groups.

As with the word-pair task, the results are more clearly presented in the form of histograms in Fig. 5, showing the number of subjects in each group who reached a perfect score (i.e., completed the task in the minimum possible number of moves, which is 8) on each of the 10 trials.

Whereas 30.8 per cent. of the normal group never reach a minimum score, 62.9 per cent. of the schizophrenics fail to do so. Again, however, it is the much greater variation between subjects and within the performance of single subjects that most distinguishes the performance of the schizophrenics from that of the normals. For, although some of the normals show little improvement on the task, they also show no evidence of the considerable "spikes" in performance seen in the learning graphs of many of the schizophrenics. That is to say, some of the patients may appear to be making a steady progress towards optimum learning of the task. They may then, for example, meet with a failure on a combination which they thought they knew. Instead of adjusting to this situation, as the normals habitually do, by making a reason-

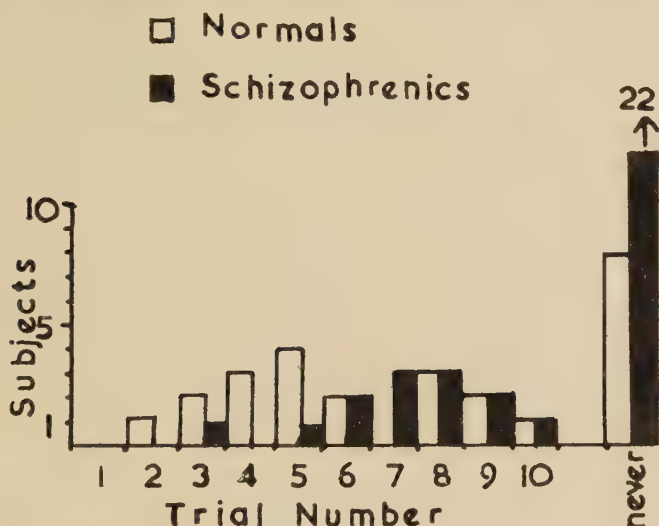


FIG. 5.—Histograms showing number of subjects in the two groups reaching perfect performance at each trial on the switch-learning task.

able trial and error to find the correct move-pattern again, they may resort to a mere repetition of the same error over and over again, so that their performance seems to break down as soon as they come upon a difficulty of this kind. Instead of facing it, they revert to purposeless movements. This accounts for the fact that the greatest number of moves ever made in one trial by a normal subject was 58, whereas many figures well above this are found in the schizophrenic records, including one trial totalling 208 moves, representing completely undirected movements of the switches.

One other feature of some interest in this connection is the sharp rise, shown in the graph of Fig. 4, in the schizophrenic curve at the third trial. Whereas a slighter rise on trial 6 is artificial, in that it is due to the great number of moves made by one patient only, this rise on trial 3 perhaps does represent a distinctive trend of some importance, because 20 out of the 35 patients were, in fact, worse in their performance on the third trial than they were on the second. It seems to represent a quite common temperamental quality in these patients to react to early failure to recall the switch positions by unintelligent

trial and error. It will be seen that the actual trial and error scores (i.e., on trial 1) for the schizophrenic patients are considerably worse than the normal. As was to be expected, there is a much less systematic approach to the problem in the schizophrenics than in the normals. The value of t obtained from a comparison of the mean number of moves of the two groups on the first trial is 2.520, which gives a probability of less than .02.

II. *Individual Variations within the Schizophrenic Group.*

We shall now examine rather more closely the quality of the individual variation on the two tasks within the schizophrenic group. In some patients the impairment is extreme, progress is almost *nil*, the quality of performance showing perseverative trends and "easy" associations on word-pairs. Although apparently co-operating, such patients have great difficulty in directing their thinking to the task which the experimenter is asking them to carry out. In other patients there is no evidence of any tendencies of this kind. Whatever the preoccupations and affective disturbances may be, the illness does not seem to have encroached upon the individual to the extent of impairing him mentally.

Briefly, we shall pick out a few illustrations of the type of impairment that is found. First, although most of the chronic cases show a fairly marked impairment, this is not invariably so. Impairment on the learning tasks seems to be related not so much to chronicity of the illness as it is to degree of impairment shown by the patient's score on a set of abstraction tests described elsewhere by Hall (1951). Certain of the chronic cases do, however, show an extreme degree of impairment in relation to what would be expected from prepsychotic intelligence. They display sometimes a complete inability to understand why, for example, the two words making up the word-pair task are "unconnected." A similar perplexity has been observed in senile organic states, and is a common observation in such patients' failure on sorting tests. For this reason, and also because "easy" familiar associations continually intruded, some of these patients made little learning progress on this task. An example from one case will illustrate the kind of responses obtained, the stimulus word given by the experimenter being shown first, and followed by the patient's response to it: Desert—Water, I should say. Old—Opposite, do you mean? Young? Storm—Wind goes with storm, so to speak. Story—Story-teller, do you mean? Time—Time marches on. Can't say; haven't a watch on me.

Although in some cases these personal easy associations gradually fell out so that a second stage was reached in which the patient began to fill up the gap from the experimentally given associations, even though incorrectly at first, a few of the patients never overcame this tendency, their failure being quite as marked as that shown by some of the older organic patients we shall mention below. It is, it seems, very far from being a simple matter to analyse the responses of these patients even in such a relatively controlled situation.

Among the acute cases also there is considerable variation. At the one extreme, the nature of the patient's failure may be clearly due to excessive

anxiety about his performance as he fails to improve. On the other hand, one patient who showed extreme thought disorder, incoherence of speech and who was visually and auditorily hallucinated on admission, was able to learn all the word-pairs correctly after the third repetition.

Although there are several cases in this group who are markedly better on the word-pair task than the switches, it is usual for impairment to be shown on both the tasks. Probably the switches task brings out more clearly the discontinuities in performance, the oscillations that are a feature of many of the schizophrenic learning curves. Further, the badly impaired patients may easily fall into patterns or stereotyped systems of movement which represent a similar tendency to that shown on the word-pairs when they produce "easy" associations.

The outstanding feature of the results is the very great *intra-group* variation, even when allowing for the differences in intelligence level, educational and occupational background, and other relevant factors. We have, at one extreme, a degree and quality of failure in certain of the chronic schizophrenics which we shall see is comparable in many ways to that of some organic patients. At the other extreme there is no evidence whatever in a few cases of any impairment or oddity in performance. It is doubtful, further, whether it is feasible to discuss the group results in terms of "incapacity" or some kind of "functional" interference. Both may clearly be instrumental in different cases. On the one hand, the failure appears to be due mainly to emotional interference such as is not infrequently found in the psychoneurotics. The failure of other patients appears to be in no way connected with emotional disturbance, the patient being typically unconcerned at his poor performance.

III. *The Learning Performance of Organic Patients.*

As with the schizophrenic group, so with the organic we find great variation in the level of performance and method of approach to these learning tasks. In this preliminary survey we have intentionally made no attempt to restrict our investigations to any particular subdivision of patients, and we find that performance ranges all the way from the apparently unimpaired to a level where there is no learning whatever, but rather a mere repetition of identical error.

The results for 10 patients tested before and at various intervals after leucotomy are shown in Table I. For convenience of tabulation, the *average* number of word-pairs correctly recalled and the *average* number of switch moves made are given in their appropriate column.

Although the follow-up on these patients has not been completed, there are indications of a considerable variation within the group. Case 1 shows a marked drop on both tasks 8 days after operation, but then returns to pre-operative level when retested some weeks later. Case 2 shows little change of any significance even at the first post-operation retest. As was to be expected, on the 8-day testing, most of the patients were considerably slower than they had been previously in tackling the switch-combination task. Apparent organic features that occur here are perseveration on the word-pairs

TABLE I.—*Learning Scores for 10 Patients, (W) being the word-pair scores, (S) the switch scores, at the intervals stated.*

Case.	Clinical description.	Sex.	Age.	Vocab. score.	Pre-operation.	Post-operation.		
						(i) 8 days.	(ii) 5-7 wks.	(iii) 5-7 mths.
1 .	Paraphrenia	M.	44	29½	W. 6.4 S. 24.2	0.5 46.0	6.0 18.4	6.6 16.4
2 .	Paranoid state with depression	M.	37	29	W. 8.0 S. 15.6	9.3 14.8	8.8 22.2	9.6 18.2
3 .	Chronic anxiety	F.	35	31	W. 9.1 S. 19.0	0.7 38.0	9.0 25.6	..
4 .	Paraphrenia	M.	37	28	W. 6.1 S. 28.2	4.3 32.8	..	..
5 .	Paranoid schizophrasia	M.	33	37	W. 7.9 S. 11.0	9.7 13.6	..	..
6 .	Simple schizophrasia	F.	25	37	W. 6.0 S. 34.0	4.5 76.4	..	4.4 24.6
7 .	Ditto	F.	38	13	W. 4.3 S. 51.6	4.9 102.6	..	..
8 .	Chronic anxiety	F.	35	20	W. . S. .	3.4 17.4	1.7 31.6	..
9 .	Chronic obsessional	M.	28	30	W. . S. .	5.8 ..	6.6	6.5 7.9
10 .	Paranoid state	M.	55	20	W. . S. .	1.1 66.2	2.0 49.8	..

in, for example, bringing up the same response word for 5 or 6 successive stimulus words. Case 1, in particular, was consistently incapable of maintaining his progress on either task. On the word-pairs his learning was superficial, the connections between the two words of a pair never being assimilated to a meaningful level. In the same way, his approach to the switches task is completely unsystematic.

We are concerned here primarily with the apparent organic features in the learning of these patients at the 8-day post-operation stage rather than with the recovery of function that most of them eventually show. From Table I it will be seen that Cases 1, 3 and 4 show little change even as early as this first stage, while Cases 2 and 6 show a very marked impairment at first, followed by a return to pre-operation level when retested at the 5-7-week stage. Clearly no conclusion should be drawn from this incomplete data, but it seems that simple, controlled tasks of the kind used may be of value in assessing reasonably objectively one aspect of the return of mental function in leucotomy patients.

We shall now examine briefly the findings obtained with a selection of the 30-40 organic patients tested. Results for 9 of these patients are shown in Table II. The tasks appear to be useful as an indication of the degree and quality of impairment, which obviously, having regard to the variety of factors involved, such as age, intelligence level, and clinical picture, shows a wide range of difference.

The first 3 cases, all of superior intelligence, were referred for psychological assessment prior to return to their normal occupations. All are of superior intelligence, and there was no evidence of impairment on abstraction tests or from scores on the Wechsler subtests. The learning tasks seem, however,

TABLE II.—*Learning Scores of a Sample of Organic Patients.*

Case.	Clinical description.	Sex.	Age.	Vocab. score.	Learning scores.	
1 .	Head injury : clinically some residual impairment 1 year after accident	M.	36	30	7·8	35·0
2 .	Tumour, left frontal region. Examined at (i) 4 weeks, (ii) 8 weeks, (iii) 3 months after surgical removal	M.	35	30	(1) 2·5 (2) 3·9 (3) 5·2	25·8 19·6 10·6
3 .	Right frontal lobectomy ; good recovery	M.	27	30½	7·9	17·9
4 .	Pre-senile dementia	M.	53	30	3·4	27·0
5 .	„ „	M.	41	17	9·0	41·2
6 .	Organic paranoid illness of syphilitic origin	F.	53	26	8·5	28·4
7 .	Chronic alcoholic	M.	41	30	5·7	23·4
8 .	„ „	M.	38	36½	6·8	10·2
9 .	„ „	M.	47	22½	5·0	27·0

sufficiently difficult to detect some impairment in both the first two patients. Case 4 shows an almost complete failure on both tasks, his performance showing no improvement whatever, with many qualitative indications of profound organic dementia. He recalled 3 word-pairs correctly on the first trial, and 4 on the tenth trial. The associations he produced were often inferences or completions from familiar connections. For "General" his response was: "Well, could be private or lieutenant, if it was in the Army." He was also typically perseverative in his errors, tending to recall repeatedly his own previous answers. The same tendencies are found on the switch learning, for which he developed a routine system, which he carried out for all the 5 combinations. He seemed quite satisfied with his system, in spite of its failure to solve the problem set. The remaining cases show a more intermediate impairment, in that some learning does actually take place, even though it may be slow and uncertain.

For such a heterogeneous group no statistical comparison with the normal is feasible, and clearly it would not be possible to indicate the degree of impairment of an individual case until large-scale standardization at the various age and intelligence levels had been carried out. Nevertheless, even at this preliminary stage the tasks produce a type of information which seems a useful supplement to the standard tests, and give many indications as to quality of performance that are of value in a comprehensive assessment of a patient's present level of function.

DISCUSSION.

The two learning tasks that we have used in this study were designed to carry somewhat further the investigations that Zangwill and Davis had made on the nature of psychoneurotic and organic impairment of learning and memory. We have extended the research by studying particularly the performance of a schizophrenic group on these tasks, because it seemed to us that the recent investigation by Huston and Shakow, giving group comparisons, contributed little to our understanding of the *nature* of the learning deficit observed, while the tasks they used were confined to performance skills.

We believe that our own investigation has brought out certain points quite clearly on this problem. The first is that to investigate this, as for any aspect of mental impairment in "schizophrenia" as a whole, can only be a *preliminary* stage in a research which should then follow up the many smaller problems that emerge from study of the very wide variations within even a small group of patients like our own. We have found that some of the patients, particularly the chronic cases, show a degree and quality of impairment which is very similar to that shown by dementing organic patients and by some early post-leucotomy patients. Such patients make little, if any, progress; they may be so anchored to familiar, easy mental associations that such word-associations are more or less consistently reproduced throughout the word-pair learning task. On the switches they may formulate a system, to which they adhere throughout the task. This, the most extreme form of impairment, is shown almost exclusively by patients who are also severely impaired on the abstraction scale. There is much to suggest that the kind of perceptual patterning that these patients show on the sorting test, for instance, and the kind of perseverative systematic error on switches together with repetition of "easy" associations on word-pairs, are all aspects of the same basic phenomenon. The whole approach of the patient to tasks that are somewhat difficult is, by these deviations, at once greatly simplified, and apparently reasonably satisfactory to the patient as a method of solution.

We can see how such an approach comes about by examining the nature of the mental processes required for good performance of these learning tasks. To learn the word-pairs, most normals make a more or less conscious effort at establishing some sort of meaningful connection between the two words that make up a pair. This is the reaction to many sorts of *unfamiliar* material that Bartlett (1932) observed and termed the "effort after meaning." It is the effort to establish the unfamiliar within a familiar frame of reference. If the patient avoids or is incapable of making this effort, he is unlikely to make any learning progress, while the reproduction of "familiar" associations is merely a completion, in the Gestalt sense, analogous to the perception and recall of a circle with a gap as a complete circle.

To learn the switch-combinations, most normals of reasonable intelligence seem to approach the task as a whole, and not merely as a set of isolated, unrelated problems. Hence we find that even their trial-and-error procedure at the first trial is likely to result in fewer moves than the impaired schizophrenic or organic will produce. There is an intelligent anticipation in the way in which the more high-grade normals link up the first position with the second, and so on, for the series. There is also in quite a number of cases a more or less conscious attempt to fix the positions in the mind by appropriate verbal formulation. All this is lacking in the impaired patient. He may follow some simple rule, which is selected more or less by chance, and apply it to all the 5 switch combinations, and will not or cannot deviate from his personal solution of the problem however much the instructions are repeated.

We have seen, however, that this extent and quality of impairment is not typical of the majority either of schizophrenics or of organic patients whom we have studied. The failure of some schizophrenics where it occurs is nearer

in kind to that which we have found some psychoneurotics show. Here there is a severe emotional interference which may make the learning curve fluctuate considerably up and down instead of progressing reasonably steadily. There may be temporary evidence of true learning, only for this to be disturbed again when, for instance, a switch combination is failed which the patient believed he knew. He then seems at once thrown back on random movement of the switches, instead of persevering with a renewed trial and error. There are many temperamental characteristics of this kind which are revealed clearly in the switch-learning task.

We should conclude, perhaps, not only by again emphasizing that many early acute schizophrenics show no evidence of learning impairment, but that there appear to be all degrees of impairment within this group, ranging from that due primarily to emotional disturbance, down to a more or less complete failure comparable in degree and quality to that shown in some cases of organic dementia. Merely because of this similarity in approach and in quality of failure we do not, of course, wish to imply that there need be any causal similarity.

SUMMARY.

1. In this study of learning impairment, two simple tasks, one consisting of 10 word-pairs, the other of switch-combinations, have been used with a maximum of 10 trials to assess some of the factors and qualities of impairment found in schizophrenic and organic patients.

2. Comparison of the performance of the schizophrenics as a group has been made with that of a normal group similar in age and vocabulary score distribution, and it is evident that the most distinctive feature of the former is the much greater intra-group variation. On further analysis, qualities of performance in the schizophrenic are assessed in relation to affective disturbance, reaction to failure, and genuine incapacity.

3. Results obtained in various organic patients are examined with a view to comparing the quality of learning failure in organic dementia with that of deteriorated schizophrenics. Certain similarities are observed between the quality of performance of some patients of each group.

We wish to thank in particular Dr. R. E. Hemphill, Medical Superintendent, for first suggesting this topic of research to us, as well as for his continued interest in its progress.

REFERENCES.

- BABCOCK, H., and LEVY, L., *The Measurement of Efficiency of Mental Functioning*. Chicago: Stoelting, 1940.
 BARTLETT, F. C., *Remembering*. Cambridge: University Press, 1932.
 DAVIS, D. R., personal communication, 1950.
 GARNNER, G. E., *Amer. J. Psychiat.*, 1931, **11**, 247-52.
 HALL, K. R. L., to appear in *Brit. J. Med. Psychol.*, 1951, **24**.
 HUSTON, P. E., and SHAKOW, D., *Amer. J. Psychiat.*, 1949, **105**, 881-8.
 TRIST, E. L., *Occup. Psychol.*, 1941, **15**, 120-8.
 ZANGWILL, O. L., *Proc. Roy. Soc. Med.*, 1943, **36**, 576-80.
Idem, *J. Ment. Sci.*, 1946, **92**, 19-34.

MATERNAL AGE IN FAMILIAL MONGOLISM.*

By L. S. PENROSE, M.A., M.D., M.R.C.S., L.R.C.P.,

Professor of Eugenics, University College, University of London.

IN recent years several writers have attempted to bring the known aetiological effect of maternal age in mongolism into direct relationship with its causation. Brousseau (1928) sifted the available data very carefully, but failed to come to any conclusion as to how maternal age could exert its effect. Benda (1947) considers that advanced age is only a subsidiary factor making maternal illness or endocrine disorder more significant, and a similar view seems to be held by Ingalls (1947). The conclusion is drawn by Geyer (1939) that mongolism is due to an abnormal ovum; if so, the older the mother, presumably the more likely are ova to be abnormal. Conversely, Engler (1949) believes that the foetal dysplasia is caused by faulty embedding of a normal ovum in uterine mucosa which has deteriorated in consequence of age, infection or surgical interference. Jenkins (1933) lays stress on the analogy with certain phenomena seen in animal genetics, for Wright (1926) had shown that the manifestation of hereditary polydactyly in guinea-pigs was influenced by the age of the dam: young mothers produced more polydactylous offspring than older ones. A similar effect has been found by Holt (1947) in polydactylous mice. There is no experimental evidence as to the nature of the mechanism involved, but it may be supposed to be physical or chemical. The search for a process akin to antigenic incompatibility has also been suggested (Penrose, 1946), immunity developing with greater ease in maturer than in younger maternal tissues. It is not necessary to look for a specifically pathological process, however, since the maternal-foetal reaction might be analogous to that in the aetiology of fraternal twins, which especially occurs at late maternal ages, which centre around 38 years.

Information about the relation of maternal age to the incidence of mongolism has been collected by innumerable observers, among the most useful surveys being those of van der Scheer (1927) and Orel (1927). Very little attention has been paid, however, to the peculiarities of maternal age which are noticeable in familial cases, that is, to the genetical investigation of maternal age effects themselves. To do this a great amount of material is required and, since the familial incidence of mongolism is slight, the accumulation of sufficient data to make analysis worth while takes many years. In the present paper all available family data from the general literature, in which maternal ages were given, is included. To this has been added a number of families investigated in connection with the writer's Colchester Survey (Penrose, 1938). Further instances were personally communicated by Halperin (1939) and

* Based on a paper read at the R.M.P.A. (Mental Deficiency Section) November 1950.

Ford-Walker (1948). Unrelated and familial cases of mongolism, recorded during recent investigations at the Galton Laboratory, are included. The remaining material was collected by Hanhart (1944) in Switzerland, and the details were very kindly made available to the present writer in 1947 and 1948. Maternal ages of all these familial cases are given in the Appendix: further details on the relationships are available at the Galton Laboratory. The data would have been considerably more extensive if earlier writers had recorded maternal ages in every case. In several instances, information was elicited on this point from the writers themselves by correspondence.

In Table I a pooled sample of 609 male and 429 female cases of mongolism, from widely different sources, is classified according to maternal age. The average for 1038 cases is 36.6 years and the standard deviation is 7.1 years. For comparison, the mean maternal age of all births in England and Wales in 1939 may be quoted, that is 28.6 years with a standard deviation of 6.0 years. In detail the data on mongolism are statistically not quite homogeneous because of an unusually high mean maternal age for females in van der Scheer's material. Nevertheless, the slightly greater mean maternal age of all females (36.97 years) is not significantly higher than that of all males (36.30 years). Brousseau's sample of 584 cases, in which sexes were not differentiated, has a still lower mean of 35.47 years with a standard deviation of 7.99 years.

An interesting point, which deserves comment, is that, in data from many sources, the distribution of maternal ages of mongols tends to be somewhat bimodal. Sometimes there are actually two maxima, one at about 27 and another at about 42 years though, more often, there is merely a rather marked skewness of the distribution.

Taking first of the familial cases the instances of two or more in a sibship, a changed character of the maternal age distribution is obvious (see Appendix). There is a far higher proportion of cases with young mothers than in the control sample, and the mean maternal age of brother and sister pairs, 34.2 years, differs significantly from the mean of the pooled sample. To some extent this reduction in maternal age can be regarded as a natural consequence of having to fit more than one affected case into the sibship. In fact, the phenomena of increased incidence in the sibship and decreased maternal age cannot be clearly separated here.

The distributions of maternal ages in other familial instances are shown in Table II. Here the instances are separated according to whether transmission of the genetical influence can be supposed to have come either through the father or through the mother. FIG. 1 shows the separation diagrammatically. In the case of affected uncle and niece, for example, the sex of the parent of the niece is the relevant factor, but nothing can be inferred about the sex of the transmitting parent of the affected uncle. When cousin pairs are affected, however, information is available concerning the transmitting parents of both cases. The means given in Table III show that the maternal ages of cases with transmission through the paternal line do not differ significantly from those in the control sample. The mean maternal age is 35.8 years for 129 such cases. However, mongols who have affected relatives on the maternal

side have a maternal age distribution comparable to that in affected sib pairs, with a mean value of 33.0 years for 121 cases. The mean of the pooled sample of the 1,038 cases shown in Table I, to which Brousseau's material has been added, making a total of 1,622 cases, is 36.2 years with a standard deviation of 7.4 years. The difference between these means, $36.2 - 33.0 = 3.2$ years, is more than four times its standard error, 0.7 years, and extremely significant

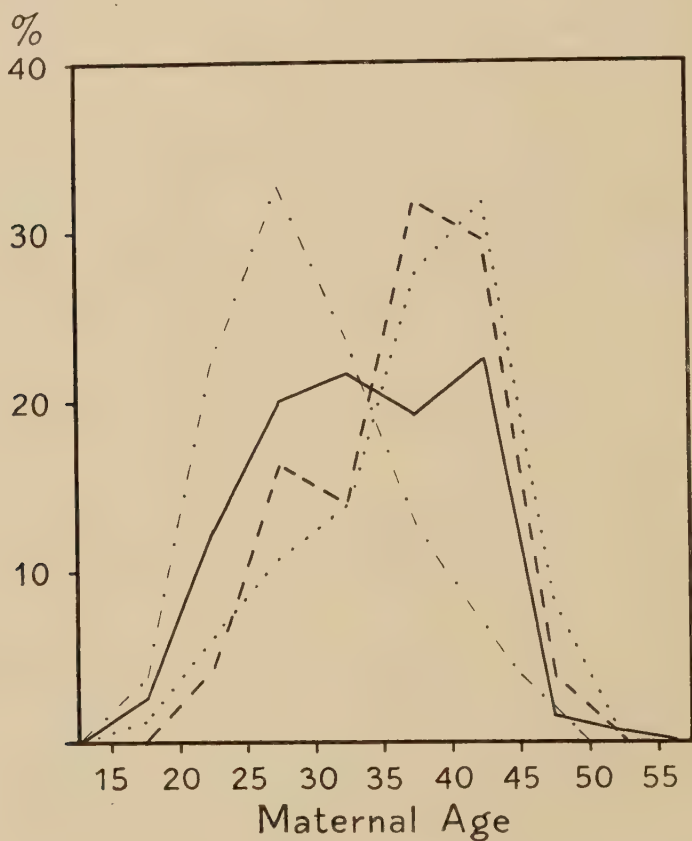


FIG. 1.—Maternal age distributions.

- Mongolism: transmission through mother (121 instances).
- Mongolism: transmission through father (129 instances).
- Mongolism: unrelated sample (1,038 cases).
- · - · - All births (England and Wales, 1939).

from the statistical point of view. Further inspection of Table III shows that the mean maternal age, 30.0 years for 10 cases, one with an affected mother, five with maternal aunts or uncles affected and four maternal half sibs, is so low as to be indistinguishable from the ordinary value for all births in the population, i.e., 28.6 years in the *Statistical Review for England and Wales* (1939).

Assuming these phenomena to be real and not just chance effects, what light do they throw upon the problem of causation? The lateness of maternal age in cases of mongolism can be perhaps regarded as evidence for a protective

mechanism whereby a fairly common hereditary trait, which predisposes the embryo to a condition of arrested growth, has been rendered relatively harmless by natural selection. That is to say, most mothers have a quality which preserves their susceptible children from mongolism until a fairly late age is reached. A few mothers might lack this capacity, on account of genetical or other peculiarities, and mongol children could be born to them at any age. If the genetical influence determining mongolism were entirely dependent upon the mother's constitution, this would be manifested by a great excess in collateral relationship between affected cases through the maternal line as compared with those through the paternal line.

If affected cousin pairs are examined separately, a slight excess is found of pairs in which two mothers of mongols are related as compared with those in which two fathers are related, provided that the relationship is fairly close. Examples of paternal line relationships are found in excess in the more distant degrees, possibly because of greater ease in tracing some of them by surnames. On the whole, the data suggest that paternal as well as maternal influences are concerned in the genetics of mongolism. The interesting point, shown in Table IV, that cousin pairs in which the parents of mongols are of like sex (73 pairs) are significantly more frequent than those in which they are of unlike sex (42 pairs), was assumed previously (Penrose, 1947) to be evidence in favour of the assumption that antigenetic incompatibility between mother and foetus might be a causal factor. This theory, however, in the simple form suggested, is disproved by the occurrence of the affected mother and child pair recorded by Lelong *et al.* (1949).

The neatest genetical hypothesis to account for the causation of mongolism would be that a single gene is responsible for the diathesis or susceptible constitution of the foetus. It can then be further supposed that, when the mother also has this diathesis, the foetus has less protection, the chance of producing affected offspring is increased and the maternal age is lowered. The frequency of the foetal diathesis can be roughly estimated by reference to the incidence of mongolism at late maternal ages, that is, 45 years or more; this is greater than 1 in 40, and may be as high as 1 in 25. Some estimates are even higher and the frequency of 1 in 10 has been suggested by Benda (1947). Though the diathesis would have a frequency of, say, one in 25, its manifestation must be of the right order of magnitude to agree with the overall incidence of mongolism at birth, that is between 1 in 600 and 1 in 700. It is possible, however, that the constitution of mothers of mongols may include the tendency to continue ovulation to a later age than is usual in the general population. If so, the estimates of the frequency of foetal diathesis based on frequency of mongols at very late maternal ages, say 50 years and over, would be misleading. If the causative single gene were supposed to be dominant (Hanhart, 1944), its frequency in the general population would be about half that of the foetal diathesis, say 1 in 50. If it were recessive the gene frequency would be much greater, say 1 in 5. The effects of these two hypotheses are difficult to separate theoretically. On the whole, the low familial incidence in sibships reaching an observed maximal value of less than one quarter even at late maternal ages (Penrose, 1932) points to the recessive

hypothesis as the more probable. Moreover, though a recessive diathesis in the foetus would be always inherited through both parents, only occasionally would either parent be of the recessive genotype like the foetus. With a gene frequency of 1 in 5, the mother would have the same recessive diathesis as the foetus in one-fifth of the cases. On the additional assumption that the homozygous mothers might give birth to mongols at younger ages than the heterozygous carrier mothers, the bimodal tendency of maternal age distributions of mongols, as shown in Table I, could be accounted for. Agreement with observation is fairly good if the assumption is made that when the mother is homozygous the manifestation of mongolism in the offspring is doubled.

It is unprofitable to enlarge upon all the different hypotheses which might be invented to account for the genetical background of mongolism. The data available at present are sufficient to exclude some theories, but they are inadequate to give confidence to any positive assumption. Although in most data male cases outnumber female cases, there is no hint of sex linkage or partial sex linkage of the hereditary factor as judged by the study of affected relatives. For example, affected sibs, collected in Table V, show no excess of pairs of like sex.

To summarize, then, all available data on familial mongolism in which degree of relationship and maternal age are specified have been assembled. Analysis leads to the suggestion that mongolism could be due to a single very common gene (frequency 1 in 5 in the general population). All homozygous foetuses are susceptible. They have a frequency of 1 in 25, but only about one susceptible case in 27 is actually affected, leading to an absolute incidence of 1 in 675 at birth. Manifestation of the condition is largely controlled by factors connected with maternal age. Maternal age in cases showing inheritance through the mother is significantly lowered. To account for this it is suggested that the defensive effect of young maternal age over the susceptible foetus is reduced when the mother herself is homozygous for the hypothetical gene, that is, when she herself is a mongol or a potential mongol. No suggestions are made about the pathology of the process by which maternal age exerts its peculiar aetiological influence.

REFERENCES.

- Anonymous, *Brit. Med. J.*, 1950, ii, 959.
 AUDEN, G. A., *ibid.*, 1947, ii, 869.
 BEALL, G., and STANTON, R. G., *Canad. J. Pub. Health*, 1945, **36**, 33.
 BENDA, C. E., *Mongolism and Cretinism*, 1947. London: W. Heinemann.
 BOROVSKY, M. F., *J. Amer. Med. Ass.*, 1928, **90**, 469.
 BROUSSEAU, K., *Mongolism*, 1928. Baltimore: Williams & Wilkins Co.
 CHOTZEN, —, *Monatschr. f. Kinderheilk.*, 1925, **30**, 120.
 DOXIADES, L., and PORTIUS, W., *Zts. mensch. Vererb. -u. Konst.-lehre*, 1938, **21**, 384.
 ENGLER, M., *Mongolism*, 1949. Bristol: J. Wright & Sons.
 FANTHAM, H. B., *S. Afr. J. Sci.*, 1925, **22**, 400.
 FORD-WALKER, N., personal communication, 1948.
 GEYER, H., *Zur Aetiologie d. mongoloiden Idiotie*, 1939. Leipzig: G. Theime.
 GLASSBURG, J. A., *J. Amer. Med. Ass.*, 1924, **82**, 1196.
 HALPERIN, S. J., personal communication, 1939.
 HANHART, E., *Arch. J. Klaus Stift.*, 1944, **19**, 549.
Idem, personal communication, 1948.
 HOLT, S. B., *Ann. Eugen. Lond.*, 1947, **14**, 144.

- INGALLS, T. H., *Amer. J. Dis. Child.*, 1947, **74**, 147.
 JENKINS, R. L., *Amer. J. Ch. Dis.*, 1933, **45**, 506.
 JERVIS, G. A., *Amer. J. Ment. Def.*, 1943, **47**, 364.
 JOHNSON, W. J., *Amer. J. Psychiat.*, 1936, **93**, 533.
 KEITH, H. M., *Brit. Med. J.*, 1948, **1**, 127.
 LAHDENSUU, S., *Monatschr. f. Kinderheilk.*, 1937, **71**, 14.
 LELONG, BORNICHE, KREISLER and BAUDY, *Arch. franç. de péd.*, 1949, **6**, 231.
 LIPNITZKY, S. J., and BOSHES, B., *J. Hered.*, 1942, **33**, 155.
 MACKAYE, L., *Amer. J. Dis. Ch.*, 1936, **52**, 141.
 OREL, H., *Zts. f. Kinderheilk.*, 1927, **44**, 449.
 PÉHU, M., and GATÉ, J., *Rev. franç. de péd.*, 1937, **13**, 212.
 PENROSE, L. S., *J. Genet.*, 1932, **25**, 407.
Idem, *J. Ment. Sci.*, 1938, **84**, 1.
Idem, "A Clinical and Genetic Study of 1,280 Cases of Mental Defect," *Spec. Rep. Ser. Med. Res. Coun. Lond.*, No. 229, 1938. H.M. Stationery Office.
Idem, material personally collected, 1939.
Idem, *Ann. Eugen. Lond.*, 1946, **13**, 141.
 TATAFIORE, E., *La Pediatria*, 1937, **45**, 238.
 VAN DER SCHEER, W. M., *Abh. a. d. Neurol., Psychiat. u. Psychol.*, 1927, **41**, 1.
 WRIGHT, S., *Amer. Nat.*, 1926, **60**, 552.

APPENDIX.

LIST OF RELATED CASES OF MONGOLISM GIVING SOURCES, SEXES, MATERNAL AGES AND DEGREES OF RELATIONSHIP DIFFERENTIATING TRANSMISSION THROUGH FATHER AND THROUGH MOTHER.

Previously unpublished instances are identified by reference numbers and/or surname initials: fuller records are available at the Galton Laboratory, University College, London.

TABLE I.—*Distribution of Mongols by Maternal Age.*
 (Control sample of unrelated cases.)

Source.	Maternal age.								Total.
	15	20	25	30	35	40	45	50	
Males:									
Galton Laboratory .	1	4	12	21	24	36	5	1	104
Penrose	3	11	11	18	52	57	17	0	169
van der Scheer (1927)	1	13	26	22	45	53	20	0	180
Orel (1927)	0	9	8	10	13	17	4	0	61
Hanhart (1948)	0	0	2	8	12	8	0	0	30
Beall and Stanton (1945)	1	5	12	7	19	15	6	0	65
Total males	6	42	71	86	165	186	52	1	609
Females:									
Galton Laboratory .	1	1	8	15	28	23	5	0	81
Penrose	0	8	8	13	21	32	9	0	91
van der Scheer (1927)	0	5	11	13	38	54	15	0	136
Orel (1927)	1	3	5	7	14	11	2	0	43
Hanhart (1948)	0	1	2	5	6	8	0	0	22
Beall and Stanton (1945)	2	4	7	7	12	17	7	0	56
Total females	4	22	41	60	119	145	38	0	429
Total males and females	10	64	112	146	284	331	90	1	1,038
Percentage	1.0	6.1	10.8	14.1	27.3	31.9	8.7	0.1	100.0

TABLE II.—*Distribution of Instances of Mongolism according to Maternal Age-group.*

Central maternal age.	Sample from Table I.		Familial instances : relationship to other affected case.			
			Through father.		Through mother.	
			Number.	Percentage.	Number.	Percentage.
17	10	1.0	0	0.0	3	2.5
22	64	6.1	6	4.6	15	12.4
27	112	10.8	21	16.3	24	19.8
32	146	14.1	18	14.0	26	21.5
37	284	27.3	41	31.8	23	19.0
42	331	31.9	38	29.4	27	22.3
47	90	8.7	5	3.9	2	1.7
52	1	0.1	0	0.0	1	0.8
Total (all ages)	1,038	100.0	129	100.0	121	100.0

TABLE III.—*Maternal Ages (in years) of Instances of Mongolism with Affected Relatives.*

Relationship of affected relative.		Relationship through father.		Relationship through mother.	
		Number of instances.	Mean maternal age.	Number of instances.	Mean maternal age.
Parent, half-sib, uncle, niece, etc.	1/2 to 1/4	7	35.1	10	30.0
First cousin, great uncle, first cousin once removed, etc.	1/8 to 1/16	38	37.0	47	33.2
Second cousin or more distant relative.	1/32 to 1/4,096	84	35.3	64	33.3
(i) All types	1/2 to 1/4,096	129	35.8	121	33.0
(ii) Control sample from Table I.	—	1,038	36.6	1,038	36.6
(iii) Sample from Table I combined with that from Brousseau (1928)	—	1,622	36.2	1,622	36.2
Difference (iii) — (i) with standard error	—	—	0.4 ± 0.7	—	3.2 ± 0.7

TABLE IV.—*Cousin Pairs Classified by Degree of Relationship and Sex of Transmitting Parent.*

Degree of relationship of mongols.*	Sex of transmitting parent.		
	Both male.	One male, one female.	Both female.
1/8	7	15	10
1/16	3	1	5
1/32	3	3	5
1/64	6	5	3
1/128	4	5	3
1/256	4	6	3
1/512	6	4	3
1/1,024	2	2	2
1/2,048	3	0	0
1/4,096	1	1	0
Totals	39	42	34

* First cousins correspond to 1/8, first cousins once removed to 1/16, second cousins to 1/32, etc.

TABLE V.—*Affected Sib Pairs Classified by Sex.*

Brother and brother.	Brother and sister.	Sister and sister.	Total.
11	23	8	42

Affected Brothers and Sisters.

Source.	Sex and maternal age.			Degree of relation-ship.	Notes.
Glassburg (1924)	m 34		m 37	1/2	—
Fantham (1925)	f 23	f 31	m 34	1/2	3 pairs.*
Borovsky (1928)	f 25		f 28	1/2	—
Johnson (1936)	m 27		f 43	1/2	—
" (1936)	m 26		f 30	1/2	—
MacKaye (1936)	m 40		m 40	1/2	Dizygotic twins.
Péhu and Gaté (1937)	m 23	m 25	f 29	1/2	6 pairs.
Tatafiore (1937)	f 27		f 34	1/2	—
Geyer (1939)	m 19		m 20	1/2	—
Auden (1947)	m 21		f 22	1/2	—
Benda (1947)	m 38		m 41	1/2	—
" (1947)	m 26	f 31	m 35	1/2	3 pairs.
Keith (1948)	f 33		m 39	1/2	*
Engler (1949)	m 40		f 43	1/2	*
Jervis (1943)	m 39		m 39	1/2	Dizygotic twins.
Halperin (1939)	f 39		m 40	1/2	—
Ford-Walker (1948)	m 40		m 43	1/2	—
Penrose 1, 2	m 38		f 42	1/2	—
" 3, 4	m 33		f 38	1/2	—
" 5, 6	m 37		m 42	1/2	—
" 13, 14	m 40		m 45	1/2	—
" 23, 24	m 20		f 23	1/2	—
" 25, 26	f 38		m 42	1/2	—
" 27, 28	f 23		f 32	1/2	—
" 41, 42	m 31		f 44	1/2	—
Hanhart 1 TMSHR	f 31		m 38	1/2	—
" 59 GD	f 30		m 40	1/2	—
" 60 BH	m 41		m 42	1/2	—
" 61 WM	f 39		f 42	1/2	—
" 62 M	f 39		f 43	1/2	—
Galton Laboratory 18, 19 S.	m 43		f 49	1/2	—
" " 154, 155 K.	f 26		f 32	1/2	—
" " 212 G.	m 32		f 37	1/2	—

Asterisk (*) indicates that maternal ages were ascertained by subsequent investigation.

Cases with Affected Parent, Uncle or Aunt, Great Uncle or Great Aunt, or Half Sib.

Source.	Sex and maternal age.			Degree of relation-ship.	Notes.
Fantham (1925)	f 23	f 31	m 34	1/4	Father's sib affected.
Hanhart 17 FRW		f 45		1/4	" " "
" 18 WB		f 38		1/4	" " "
" 19 REK		f 35		1/4	" " "
Anonymous (1950)		m 40		1/4	" " "
Penrose 37, 38		m 32		1/8	" half-sib affected.
" 39, 40		m 42		1/8	" aunt affected.
Lelong <i>et al.</i> (1949)		f 30		1/2	Mother affected.
Doxiades and Portius (1938)		m 19		1/4	Mother's sib affected.
Hanhart 58 F		f 34		1/4	" " "
Galton Lab. 185, 187 TB		f 37		1/4	" " "
Anonymous (1950)		f 39		1/4	" " "
Penrose 11, 12		m 22		1/4	" " "
" 33, 34		m 42		1/8	" uncle affected.
Lahdensuu (1937)	f 25		m 35	1/4	Maternal half-sibs.
Hanhart 57 MM	m 29		m 33	1/4	" " "

Pairs of Affected Cousins.

(A) Father of (i) related to Father of (ii).

Source.	Sex and maternal age.		Degree of relationship.
	(i)	(ii)	
Lipnitzky and Boshes (1942)	f 45	m 34	1/8
Ford-Walker (1948)	f 28	m 36	1/16
"	f 28	f 34	1/16
"	f 34	m 36	1/8
Penrose 9, 10	f 45	m 34	1/32
" 21, 22	m 38	m 44	1/8
" 31, 32	f 41	m 34	1/8
Hanhart 1 TMSRH	f 42	f 31	1/64
"	f 42	m 38	1/64
" 2 HLS	m 41	m 23	1/2,048
"	m 41	m 43	1/1,024
"	m 23	m 43	1/64
" 3 WES	m 24	f 29	1/512
"	m 24	m 43	1/512
"	f 29	m 43	1/512
" 4 GHH	f 39	m 40	1/512
"	f 39	f 41	1/512
"	f 14	m 40	1/8
" 5 RJ	f 28	f 32	1/256
" 6 AZ	m 40	m 41	1/256
" 7 LB	m 36	m 37	1/256
" 8 HH	f 42	f 33	1/64
" 9 TE	f 31	m 41	1/64
" 10 S	m 41	m 35	1/8
" 11 G	m 42	m 42	1/32
" 12 F	f 40	m 37	1/8
" 13 SWW	f 37	f 49	1/32
" 14 DW	f 38	m 35	1/16
" 15 SG	f 27	f 41	1/128
" 16 OK	f 36	m 25	1/128
" 42 SSME	m 43	f 32	1/128
" 43 MA	f 28	m 26	1/128
" 45 F	m 39	m 36	1/256
"	m 39	m 36	1/512
"	m 39	m 25	1/2,048
"	m 36	m 37	1/64
"	m 36	m 25	1/1,024
"	m 25	m 37	1/2,048
" 46 HTW	f 30	f 38	1/4,096

(B) Mother of (i) related to Mother of (ii).

Source.	Sex and maternal age.		Degree of relationship.
	(i)	(ii)	
Chotzen (1925)	f 48	f 30	1/8
Borovsky (1928)	f 25	f 39	1/8
"	f 28	f 39	1/8
Penrose (1938)	m 21	f 27	1/8
"	m 21	f 24	1/8
"	m 21	f 21	1/16
"	f 27	m 24	1/8
"	f 27	f 21	1/16
"	m 24	f 21	1/16
Penrose 7, 8	m 50	m 38	1/8
" 37, 36	m 39	m 41	1/8
Galton Laboratory 109, 111 G	m 40	m 30	1/32
"	f 43	m 40	1/32
"	f 43	m 30	1/32
" 102, 94 T	m 45	m 44	1/16
" 213 S	m 40	f 34	1/32
Hanhart 1 TMSRH	f 31	m 33	1/64
"	m 38	m 33	1/64

Pairs of Affected Cousins—cont.

(A) Father of (i) related to Father of (ii).

Source.		Sex and maternal age.		Degree of relationship.
		(i)	(ii)	
"	44 MGS	f 40	m 35	1/8
"	47 KRP	f 30	f 42	1/1,024
"	"	f 30	f 19	1/1,024
"	"	f 42	f 19	1/128
"	48 GKH	m 27	f 43	1/128
"	"	m 27	m 24	1/512
"	"	f 43	m 24	1/512
"	49 KSSS	m 43	m 31	1/16
"	50 K	m 32	f 30	1/8
"	51 B-U	m 27	f 39	1/256
"	52 KB	f 38	m 25	1/256
"	53 LB	m 34	m 21	1/256
"	54 MAE	m 24	f 42	1/64
"	55 ZW	m 39	f 42	1/64
"	56 SW	f 32	m 35	1/128
"	44 MGS	f 33	f 26	1/512

(c) Father of (i) related to Mother of (ii).

Source.		Sex and maternal age.		Degree of relationship.
		(i)	(ii)	
Anonymous (1950)		m 40	f 39	1/8
Galton Laboratory 109 G		f 43	f 40	1/8
Penrose 19, 21		m 39	f 43	1/8
" 29, 30		f 23	m 44	1/32
Hanhart 1 TMSRH		f 31	f 36	1/128
"	"	m 38	f 36	1/128
"	20 HA	m 28	m 26	1/32
"	21 DP	m 40	f 37	1/8
"	22 RH	f 42	f 28	1/8
"	23 HA	m 41	f 38	1/256
"	24 GT	m 29	m 34	1/128
"	25 OB	f 45	f 42	1/256
"	26 KK	m 41	m 30	1/64
"	27 RR	m 45	m 39	1/64
"	28 SR	f 38	f 28	1/64
"	29 NS	m 29	f 34	1/8
"	30 VC	f 39	f 35	1/8
"	31 BH	m 43	f 34	1/8
"	32 G	m 37	m 36	1/8
"	33 FFR	m 41	m 35	1/8
"	34 KR	f 43	f 31	1/8
"	35 SD	f 31	f 33	1/16
"	36 MPSS	f 40	m 36	1/64
"	37 LHND	m 41	f 40	1/128
"	38 WR	m 35	f 42	1/8
"	39 MHS	m 42	m 20	1/8
"	39 MHS	m 42	m 20	1/8
"	40 GHRV	f 35	m 42	1/64
"	41 GZ	m 27	f 29	1/512
"	42 SJME	f 32	f 27	1/512
"	43 MA	f 28	f 33	1/256
"	44 MGS	f 36	f 40	1/8
"	"	f 36	m 35	1/8
"	45 F	m 39	m 27	1/1,024
"	"	m 36	m 27	1/512
"	"	m 25	m 27	1/1,024
"	"	m 37	m 27	1/256
"	46 HTW	f 30	m 44	1/32
"	"	f 38	m 44	1/4,096
"	42 SJME	m 43	f 27	1/512
"	43 MA	f 28	f 26	1/256
"	"	m 26	f 33	1/256
"	"	m 26	f 26	1/128

AN EXPERIMENTAL APPROACH TO DIAGNOSTIC PSYCHOLOGICAL TESTING.

By M. B. SHAPIRO, M.A.,

Department of Psychology, Institute of Psychiatry, Maudsley Hospital,
London.

OUTLINE.

- A. Introduction.
- B. Function and Characteristics of a Test.
- C. Difficulties Arising in the Use of Tests.
 1. The Problem of Error.
 2. Inadequacy of Information.
 3. Difficulty and Expense of Production.
 4. Inherent Limitations.
- D. Various Methods of Using Tests.
 1. The "Qualitative" Approach.
 2. The "Flexible" Approach.
 3. Experimental Method.
- E. An Example of the Application of Experimental Method.
- F. How the Experimental Method Helps to Meet the Main Difficulties.
 1. The Lessening of Error.
 2. Providing an Alternative to the Standardized Validated Test.
 3. Overcoming the Inherent Limitations.
- G. Outcome of the Experimental Method.
 1. Testing only to Answer Definite Questions.
 2. Limiting "Test Interpretation."
 3. The Abandonment of the "Artistic" Approach.
 4. Qualifications of the Goldstein-Scheerer Approach.
- H. Obstacles in the Way of Developing Experimental Procedures.
 1. Pressure from Colleagues.
 2. Understaffing.
 3. Misconceptions.
 - (a) The Role of the Psychologist.
 - (b) Multiple Causation.
- I. Discussion.
- J. Concluding Summary.

A. INTRODUCTION.

The symposium of the 1950 General Meeting of the British Psychological Society on the use of tests in clinical psychology showed that there was considerable difference of opinion on the way in which tests could and should be used in diagnostic work. As testing is one of the main activities of psychologists working in the clinical field, it is of some importance that this discussion be continued in written form. In this way misunderstanding can be clarified and opinions fully expressed.

B. FUNCTION AND CHARACTERISTICS OF A TEST.

It is necessary to begin with a brief review of the psychiatric needs which give rise to testing. First of all, in order to help in diagnosis and in making decisions about treatment and disposal, the clinician requires information about the patient's past and present efficiency, about his attainments, personality and range of interests. Such information is as important for patients with clear-cut organic disorders as it is for patients with behaviour disorders. Even when such information is available, it is often difficult to obtain quickly, and often subject to the distorting effects of subjective factors on both the clinician's and other people's judgments.

In addition to the descriptive demands, the clinician finds it useful to have information of directly diagnostic import. For example, it may be useful to know that certain score patterns on motor tests are seldom to be found in neurotics, but are frequent in psychotics, or that certain types of results in the Block Design Test are only produced by brain-damaged patients.

Finally, the clinician often has to have independent indices of the course and effects of treatment. For example, it may be important to measure the changes in the level of intellectual ability of a paretic receiving penicillin treatment.

To fulfil such needs, the procedures used by the clinician must have three essential characteristics :

i. They must be objective, in the sense that they are as independent as possible of the clinician's changing moods and experience. Standard situations and standard methods of evaluating responses are necessary.

ii. The clinician must be able to compare a given performance of a patient with that of mentally healthy subjects, and of subjects having different degrees of the patient's own and other illnesses.

iii. Finally, it is necessary to know as much as possible about the factors affecting the performance of the task in question, and to what extent it really does involve the function under investigation.

We have here, in effect, three essential characteristics of a test : it must be objective, standardized, and validated before it can be brought into clinical use.

As soon, however, as we bring the test into clinical use, new problems arise, and it is these problems which will now be discussed.

C. DIFFICULTIES ARISING IN THE USE OF TESTS.

1. *The Problem of Error.*

Error is inherent in all measurement, and it is necessary to know its extent. This would appear to be a statement of the obvious. A survey of some of the current literature dealing with diagnostic testing and discussion with clinical psychologists soon shows, however, that it is necessary to introduce the discussion of these problems into the field of clinical psychology. For example, many psychologists will confidently use the items of the Terman-Merrill Binet as indicative of abilities such as spatial imagery, memory, and so on without regard for the fact that the reliability of these items has been shown by McNemar (6) to be extremely low and that their validity has not been demonstrated. On the other hand, the discussion of error by the non-clinical psychometrician is often remote from the real problems of clinical work.

For the clinician the problem is a relatively simple one; it is that a given result on a test may, for a number of reasons, give a seriously incorrect impression. Take unreliability as an example. Let us assume that we have a test with a test-retest correlation of .9 and a standard deviation of 16. These data mean that, out of every three children obtaining an average score of 100, one would obtain a re-test score above 107 or below 93.* On the basis of the same data, out of every 10 children obtaining an average score on the first test, one child would obtain a score above 112 or below 88 on the second test. (These two illustrations assume that no learning has taken place.)

It is conceivable that, for the purpose of group selection, the relatively small error of misclassification arising out of a correlation of .9 would be preferable to the much larger error resulting from unstandardized and unvalidated procedures. For the clinical worker, however, error takes on a different aspect. The psychologist does not wish to make a serious mistake with any patient, and he needs to know when he is dealing with that one person in ten.

The error of unreliability is not, of course, the only kind of error that arises for the psychologist. It is the error of misclassification that arises from imperfect validity which is crucial. It will not be necessary to labour the point that a test of perfect reliability but very low validity is not of much use to the tester. Validity coefficients as high as .9 are very rare for tests in current use, so the chance of being seriously wrong about a patient on the basis of the test results is far too large for comfort.

The psychologist's worries are not ended, unfortunately, by a consideration of the errors of unreliability and invalidity. A third source of difficulty arises from the apparent impossibility of obtaining exactly representative samples of the population for the standardization of tests. This results in some distortion when considering the scores obtained on two different tests of the same function, or when considering scores in the same test given at different ages. The possible range of this kind of error is indicated by the data published by Dearborn and Rothney (3). They gave nine different group tests of intelligence and the Stanford-Binet to 320 children over a period of 12 years. The

* The formula for the standard error of estimate is used: $\sigma_e = \sqrt{1 - r^2}$. In the above example $\sigma = 16$ and $r = .9$.

median score on the Binet was 102. The lowest median score obtained was 94 on the Otis Intermediate Form A, and the highest median score was 110 on the Haggerty Intelligence Examination, Delta 2. While the results of this study are by no means conclusive, they at least indicate the possible range of error that might arise from the differences in the samples on which the tests were originally standardized.

2. *Inadequacy of Information.*

A further complicating factor for the psychologist is that, not only must he take into account the possibility of considerable error, but more often than not he is in no position to do so because the makers of the test do not provide the necessary information. For example, the Terman-Merrill Binet is the only test on the market for which reliabilities for most levels of I.Q. and three main age-groups have been estimated. In contrast to this, many test constructors are content to publish one or two test-retest correlations. Some well-known British tests have been published without measures of dispersion, with the result that it is impossible to obtain a precise estimate of a subject's standing on the test. In any case, most of the tests in clinical use have been standardized in America, and have not been re-standardized for British populations.

The general effect is that the clinical psychologist not only has to deal with the problem of error, but is not given sufficient data on which to estimate its amount.

3. *Difficulty and Expense of Production.*

The psychologist's difficulties are increased by the fact that, not only are his instruments subject to error, but he very frequently lacks instruments which he badly needs. This arises from the fact that a well standardized and validated test takes a long time to make; and no matter how well a test has been standardized for the general population the psychologist who is serving a particular area in the end needs tests which have been standardized for that area. A psychologist doing clinical work rarely has the opportunity or the time to make the appropriate instruments for himself. Such efforts are costly and time-consuming.

4. *Inherent Limitations.*

There is a final difficulty which emerges sooner or later for the clinical psychologist. This arises from the fact that some questions cannot be answered at all by the procedure of the standardized validated test. For example, we may want to know how much of a patient's deafness is due to physical factors and how much due to hysteria. The fact that the patient obtained a maximum score on a hypothetical test of "hysteria" would not give an answer to this question. However, an *ad hoc* experiment carried out with the P.G.R. might give us a fair indication of the extent to which the actual deafness was being influenced by hysterical factors. The P.G.R. could be used to indicate differences in responsiveness to emotional, meaningful and meaningless stimuli, which could be presented from the range of tones which the patient claimed he could not hear.

Again, the question as to whether a patient's tic is increased or decreased by a condition of tension may help to answer a diagnostic question. Here, as before, the question is answered, not by a test, but by an experiment designed to give a specific answer. This would take the form of placing the patient in conditions of varied tension, and observing the changes in the frequency of the patient's tic in relation to these situations.

This kind of difficulty means that there are descriptive needs other than those described in Section B above. The clinician frequently needs to know the precise factors, and their inter-relation, which have produced a given symptom or disorder in an individual case, and the standardized validated test often cannot provide an answer to such questions.

In summary, it would appear that there are four main difficulties in the use of tests. There are first of all the difficulties of error. Secondly, we have the fact that for most tests the necessary information is not available which would allow us to estimate the amount of error. Thirdly, there is a shortage of necessary tests and the difficulty and expense of making them. Finally, there are inherent limitations to the use of the standardized validated test. Certain questions important for diagnosis cannot be answered by this technique.

These difficulties do not mean that we should discard the standardized validated test for clinical purposes. The psychiatric needs which give rise to the use of the test will remain, and so do the requirements for fulfilling them. The psychiatrist still needs tools for the effective description and diagnosis of his patient and an independent measure of the course and effect of treatment. Consideration of objectivity, validity and standardization must inevitably operate in answering such questions. What has happened here is that, as in many other fields, the solution of a certain problem results in the clearer emergence of others, and it is towards the solution of these other problems that we must now turn our minds.

D. VARIOUS METHODS OF USING TESTS.

The reaction to problems arising out of the interpretation of test results in the clinical field has been varied, and it is now proposed to discuss some forms which it has taken.

1. *The "Qualitative" Approach.*

One development has been to differentiate between supposedly mere "quantitative" and "qualitative" aspects of mental testing. An example of this is provided by R. Schafer (8) on p. 17 of his book. He states: "A test response is not a score; scores, where applicable, are abstractions designed to facilitate intra-individual and inter-individual comparisons, and as such they are extremely useful in clinical testing. However, to reason—or do research—only in terms of scores and score-patterns is to do violence to the nature of the raw material. The scores do not communicate the responses in full. For example, in response to the question 'Why should we keep away from bad company?' both of the following responses obtain a maximum score of 2: 'They have a terrible influence on our character and lead us into evil ways,' and 'I don't have much use for the concept bad company but we're supposed

to believe that they will corrupt us.' . . . The subject communicates more than he wittingly intends; he also communicates more than can be scored. Test responses, because they represent the subject's style of thinking, allow for inferences concerning predominant features of character make-up."

The counterposing of the qualitative versus the quantitative approach in mental testing appears to be based on two fallacies. The first fallacy is that, because an observation is "qualitative," it ceases to be subject to the rules of reliability, standardization and validation. In fact, to observe an hysterical quality of a patient's response does not necessarily mean that the patient has an hysterical personality, unless evidence has been obtained which validates this notion. Nor does it mean that different observers would necessarily judge the response to be equally hysterical; or that, if they agreed in their judgment, the patient's response was any more hysterical than that of any other person.

A second misconception implied by this approach is that qualitative observations cannot be quantified. In fact, the quantification of qualitative observations in an objective manner is primarily a question of ingenuity and the level of technical development of science. For example, it would be possible to make up a number of questions, of the kind mentioned above by Schafer, which would provide an opportunity for measuring hysteric-like responses. A definition of hysterical quality could be set up as a scoring criterion and the test could be administered, resulting in a quantitative score in terms of the number of hysterical responses. These would then be subject to the usual psychometric treatment.

It seems, therefore, that when a psychologist generalizes from hysterical features in a patient's responses to the Comprehension subtest, he is in fact using an unstandardized and unvalidated test. The only use for such observations, therefore, must be that they serve as hypotheses to be tested by proper investigation.

2. The "Flexible" Approach.

Many psychologists who look upon the testing situation as a method of evoking qualitative responses have gone much further than Schafer does. It was quite clear at the 1950 General Meeting of the British Psychological Society, for instance, that some psychologists do not believe it necessary to give a test in exactly the manner demanded by the designer of the test. They claimed that this imposes a restriction on the investigation of a patient, and that the test should be used in what might be called a "flexible manner." This approach is subject to a number of criticisms and qualifications. In the first place, the claims to get better results by so-called more flexibly used tests is subject to the same needs of validation as any other claim. Precise evidence would have to be supplied that such methods produce as good or better results than the more rigorous methods.

A second criticism is that this approach implies that the psychologist must choose between the rigorous standard approach to the patient, and the flexible one. In fact the psychologist finds it necessary to use both methods. The main question is to decide on the appropriateness of the given method.

If the question concerns the patient's relative standing on a test, then any

change of procedure must be avoided. If, on the other hand, the psychologist is searching for hypotheses to account for some of the patient's responses, he might find it useful to conduct an uncontrolled inquiry. For example, the psychologist may believe that the patient's responses in an individual test are being affected by his nervousness. This suspicion should not affect the actual content of the situation presented or the scoring of the responses. When the test is over and the patient appears to be more settled the psychologist might well return to some of the items involved, and ask the patient some questions about them to see how much and what kind of help is necessary to obtain a correct answer. Such inquiry would provide the basis for further investigation.

It is usually only in extreme cases, where no responses at all have been obtained, that procedures have to be modified. Such modifications should be minimal, just enough to make the difference between no response and some response. The usefulness of the free inquiry does not justify the claim that loosely controlled inquiries are valid. Without any proof, this can open the door to dangerous practices—dangerous, that is, to the interests of the patient.

The third weakness in this approach is the assumption that a completely free approach is the only way in which the full co-operation of the patient can be obtained. In fact, one of the main skills of the psychologist lies in his ability to obtain the co-operation of the most intractable patient under conditions which depart as little as possible from those laid down.

The last two points are illustrated by the following examples: The psychologist had to give a Binet to a 4-year girl whose main complaint was that she did not talk. He hit upon the expedient of placing the little girl on his knee and giving her a kiss for every item which she completed, regardless of whether it was right or wrong. Every item was presented and every response scored rigorously according to the instructions in the manual—with the one exception of the reward for responses. The patient completed enough of the test to show that mental defect was not to be considered in her case, and she walked out of the testing room talking to and kissing everybody that she met. A second example was an adolescent girl who would not talk and was thought to be a mental defective. The patient was persuaded to indicate by a slight movement of the finger which of the items in the matrices was her choice. Here again she chose enough of them correctly to indicate that she was not a mental defective, but that she was essentially a psychiatric problem. In both of these cases the instructions and the scoring methods were adhered to as closely as possible, and the findings were of undoubted value in the diagnosis of the patients' disorders. If the adherence had not been so close, the contra-indications of mental defect in these cases could not have been so definitely made.

3. *Experimental Method.*

It would seem that the correct reaction to the difficulties inherent in testing would lie in the psychologist's trying to find a way in which he can carry out his descriptive and diagnostic functions more effectively. It is the main thesis of this article that this can best be done by making explicit the underlying principles of these functions, by formulating in general terms what every clinician does when he is investigating a patient.

First of all, the features presented by the patient, his life history and medical history and test results are integrated. In this the discussion between the psychiatrist, social worker and psychologist play an important part. As a result certain formulated problems emerge.

The next move is to advance hypotheses which will explain them. This is in essence what the clinician always does, though at times he will not be inclined to admit it.

The third step the clinician takes is to ask himself what effect the truth of each of his hypotheses will have on the treatment and disposal of the patient. If any of these hypotheses are not likely to have an effect on treatment and disposal, he will be disinclined to test them.

Finally, the clinician has to decide how he is going to test the various hypotheses.

We would submit that these four phases are, in fact, always carried out when a clinician makes a diagnostic decision. Making them explicit helps us to evaluate the various procedures which are used in diagnostic work, and it helps to carry it out more effectively and economically in terms of time. When we turn again to the standardized validated test it becomes immediately apparent that it is not the only way of testing a hypothesis. The ways of doing this are as varied as the whole range of human observation. For example, one hypothesis to explain a pre-school child's disorder might be that it is a reaction to the restrictiveness of an over-tidy, meticulous, houseproud mother. If, however, one visits the home and finds that it is untidy, neglected-looking, and that the mother is on her way out to go dancing with a man who is not her husband, then the hypothesis is strongly contra-indicated. Similarly, the hypothesis that a child is over-inhibited may be contra-indicated by mere observation of the child in his relations with other children. On the other hand, if a validated and standardized test of inhibition were available, the answer to the same question might well be available more quickly and more unequivocally than, say, the observation of the child's behaviour. The methods open to the psychologist are many; the essential characteristics of the investigation are, however, always the same.

E. AN EXAMPLE OF THE APPLICATION OF THE EXPERIMENTAL METHOD.

In the interests of brevity, the case analysed here is to some extent a hypothetical one. The patient is a 10-year-old girl who comes to the hospital suffering from enuresis. Other information about the patient presents a picture of a quiet, rather retiring girl who has done averagely well at school and has shown no outward behaviour problems. In the course of the admission routine she was given the Terman-Merrill Binet; she obtained a quotient of 120 and a score of 7 words correct on the Vocabulary. Statistical computations show that this discrepancy is rarely to be found in the normal population.*

* The formula used was (as provided by A. Lubin):

S.D. of difference between I.Q. and Vocab. = $\sqrt{\sigma_B^2 + \sigma_V^2 - 2r\sigma_B\sigma_V}$,

where σ_B = standard deviation of the Binet,

σ_V = " " " " " " Vocabulary,

r = correlation between Binet and Vocabulary.

The data can now be classified in the following way : The child is superior in her Binet performance, average or unexceptionable in her school work and general behaviour, and exceptionally bad in the Binet Vocabulary. The main problem is formulated in this way because, as psychologists, we have to look at the problems mainly from the point of view of our test results. Four hypotheses are put forward :

(1) The patient is an extremely intelligent child who comes from an abnormally poor social and economic environment, resulting in the poverty of her vocabulary and in frustration which may be a factor in her present disorder.

(2) The patient is an extremely intelligent child who suffers, for an unknown reason, from an extreme degree of emotional inhibition which results in breakdown in a controlled interview situation like the Binet Vocabulary test. However, her intelligence is great enough for her to be able to get by in most situations to which she is accustomed.

(3) The low Vocabulary score is due to a temporary, but extreme disturbance coincident with her arrival at the clinic, if not related to it, and would never be repeated. It therefore has no diagnostic significance. The Vocabulary test was the first given to her and was, in fact, the first effective contact with the clinic.

(4) The inability to express herself verbally is due to some kind of specific aphasic defect in a child who is of bright, but not necessarily as great intelligence as would be indicated by hypotheses (1) and (2). This defect may or may not be related to the patient's disorder.

Note that none of these hypotheses are mutually exclusive, nor do they necessarily account for the disorder.

The next step in our procedure is to examine each of the four hypotheses to see what effect the truth of each would have on the treatment and disposal of the patient. It is obvious that hypotheses (1), (2) and (4) would considerably affect our lines of treatment. Hypothesis (3), if it were true, would result in our closing the investigation of the test results, and no further contribution to the case could be expected from this particular point. It is worth our while, therefore, to investigate all these hypotheses and so we move to the next stage, that of designing tests for each one of them. The first hypotheses can be tested by direct inquiry from the social worker on the basis of a visit she has paid to the home. If she finds that the home is a superior working-class one, with varied cultural interests, and the child herself spends a large proportion of her spare time reading books like the *Children's Encyclopaedia* and children's classics, then we can fairly say that the hypothesis has been disproved.

Hypothesis (2) can be taken up in a variety of ways, depending on the amount of time at our disposal. If we are extremely busy we may look for a merely confirmatory test, such as giving the child the Mill Hill Vocabulary Test, together with a repeat of the Binet Vocabulary. The Mill Hill Vocabulary is a group test and the child can be left alone to answer it, thus eliminating the personal face-to-face situation which is supposed to have lowered the Binet Vocabulary performance. If the score on the Mill Hill Vocabulary were significantly higher statistically than that predicted from the Binet Vocabulary, the hypothesis would be confirmed but not proved. There may

be other reasons why the child finds the Mill Hill type of test easier to do. With more time at one's disposal, one might set up an experiment in which the individual and group type tests are given in some kind of balanced order. Here again, if the results are in the direction predicted, they would only be confirmatory. A third way of handling the situation would be to use a valid test of inhibition. Such a test, while its finding would be of direct clinical use, would still only be of a confirmatory character because it would not necessarily prove that there was a causal relationship between the child's inhibition and performance on the Binet Vocabulary. The only way in which we could make a crucial test of the hypothesis would be if we were able to set up the inhibition as an independent variable and vary its intensity in the patient, at the same time measuring the effect of such variation on the dependent variables: individual and group type vocabulary tests.

It must be remembered that the results arising out of the first testing of an hypothesis may result in the reformulation of the problem and the devising of a new hypothesis. An investigation becomes, therefore, a process in which every new fact results in the re-formulation of hypotheses and every re-formulation can result in the unearthing of new and relevant facts. Thus the work of the psychologist does not stop at the first formulation of problems and hypotheses.

F. HOW THE EXPERIMENTAL METHOD HELPS TO MEET THE MAIN DIFFICULTIES.

It is now necessary to review the earlier statement of the difficulties arising out of the use of the validated standardized test to see to what extent the conception of experimental method really meets these difficulties. How does it make up for the inadequate information about the tests and the lack of suitable tests? Finally, does it enable us to answer questions about the precise relationships of factors within an individual patient?

1. *The Problem of Error.*

All methods of scientific investigation are, of course, subject to error. Crucial tests for hypotheses are provided with relative rareness: so, while the results may be consistent with an hypothesis, the underlying causes may, in fact, be different from those suggested. Any conclusions, therefore, which are drawn from such data would be in danger of error.

The experimental method, however, does help to reduce a good deal of the error arising from the use of ordinary standardized validated tests. If, for instance, in the detailed example described above, the first test results were to be taken strictly at their face value, they would merely indicate that the child was of superior general intelligence but that she had an extremely poor vocabulary. Actual investigations did show in this particular case that her vocabulary was, in fact, commensurate with her Binet test score, but that it was the combination of her own personality and the peculiarities of the test situation which depressed her test score considerably. It is the investigation into the observed discrepancy which, in fact, prevents the drawing of incorrect

conclusions about the patient ; and thus we can say that in this case the use of experimental method reduces the extent of error which arises from the naïve use of standardized validated tests.

2. *Inadequate Information and Difficulty of Standardization and Validation of Tests.*

The inadequate information about available tests and the difficulties in making tests which are needed were the second and third difficulties mentioned in Section C. Here again the use of experimental procedure helps us to overcome such difficulties. This is illustrated by a patient who was a deaf mute, and whose difficulties were not at a sensory, but at a perceptual level. One question which arose was that of his trainability. No test of "trainability" for this kind of patient exists. This question was answered by training him to carry out various tasks under controlled conditions. Where before he had scored zero on Raven's Matrices and the Porteus Maze, he now performed such tests at about average level. These results seemed to contraindicate the diagnosis of schizophrenia or general mental defect, and gave positive indications of his "trainability."

3. *Overcoming the Inherent Limitations.*

It was pointed out in Section C that there were inherent limitations in the standardized test procedure. Examples were given of a patient with hysterical deafness and a patient with a tic to show how, in fact, a hypothesized causal connection between the symptom and the variable can be tested by an experiment. Such a connection, of course, cannot be demonstrated by the ordinary test. The case outlined in Section E above provides another example of the way in which answering the question posed by an individual case requires the testing of specific hypotheses about it. A standardized validated test of inhibition, while it could give results which have a bearing on the main hypothesis, would not show to what extent the child's inhibition was in fact related to her low Vocabulary score and in turn to the enuresis. It is direct experiment which might give a much more accurate indication of this.

G. OUTCOME OF THE EXPERIMENTAL METHOD.

I. *Testing only to Answer Definite Questions.*

The general approach described above means that no test is given to a patient—in fact no inquiry of any kind is made—unless a definite question is being answered, i.e., a definite hypothesis is being tested.

This approach is, of course, in contrast to the battery approach favoured by many psychologists, and which appears to be characteristic of the work of some American clinical psychologists. For example, Schafer, in considering the main propositions in the clinical application of psychological tests, states: "The subject must be made to think in a variety of problem situations to enable the examiner to distinguish the pervasive, fundamental or pathological aspects of his characteristic adjustment-efforts. In any one situation he may

present a one-sided picture ; in a variety of situations—in a *battery* of tests—a rounded and hierarchical picture can be expected ” (8).

Actually, completion of a “rounded and hierarchical picture” does not necessarily provide any check against error. The battery of tests is just as much subject to the demands of validation as a single test, and each additional test must be shown to contribute to predictive efficiency.

There can only be three reasons for giving a patient a test : either it has been shown to differentiate certain qualities of validated importance for diagnosis, treatment or disposal, with a known degree of error ; or there is agreed and long clinical experience indicating the possibility of the validity of the test ; or, finally, the test is deduced from certain specific hypotheses entertained about the patient. The notion of validity is inherent in all testing work.

It does not follow from this, however, that the routine test battery approach has no place in clinical work. Procedures must be routinized when it is found that certain questions nearly always arise in the course of the investigation of a patient, and that validated procedures exist which can give the answer to these questions. For example, under present conditions, the important question that always arises with children is the level of their various abilities, and therefore it becomes necessary to make intelligence tests part of initial clinical routine. If gradually the number of such questions which can be answered in this way increases, then we will have the development of a battery of tests.

However, there seems to be little advantage in developing a time-consuming battery approach utilizing unvalidated tests to verify hypotheses which no one has advanced. It would seem to be far better to spend the time validating by experiment specific hypotheses about patients, or to carry out long-term research which would enable us to inaugurate useful routine procedures.

2. *Limiting “Test Interpretation.”*

Another approach which is, of course, related to the battery approach, is that which rests mainly on the integration of all available data about the patient. Rosenzweig (7) has explicitly formulated a rationale and a method of such an approach : “Taking it for granted that all expressions of personality are, if properly understood, meaningfully related to each other, the interpreter attempts to single out the cardinal strengths and weaknesses, drives and interests, attitudes and symptoms in terms of which the various manifestations of the person seem to be most significantly oriented.”

The method which he uses in operating this approach is the method of “minimum hypothesis,” which he described in the following way : “The picture of the subject that will in the end be embodied on the psychological report must account for the largest number of underlying or explanatory variables. When two alternative interpretations are in competition, the foregoing statement provides the only currently accepted basis for deciding between them.”

This use of the “minimum hypothesis” would seem to be an application of the law of parsimony. This can only apply when all the available evidence has been gathered and more than one hypothesis can satisfactorily account

for *all* of the evidence. If, however, the principle is used merely to analyse the evidence which has been gathered up to date, and becomes in effect a reason for relinquishing further investigation, then the principle of the "minimum hypothesis" becomes a factor which limits the effectiveness of the psychologist's investigations. The best rule for the psychologist would seem to be that, if he has more than one hypothesis which can adequately explain the data which he has gathered, he should perform a crucial experiment which would enable him to decide which of the hypotheses would, in fact, account for the data. Merely to present an "explanation" to the psychiatrist is not good enough. An unsubstantiated explanation is an untested hypothesis.

This does not mean, however, that the psychologist must not carefully relate all his available data pertaining to the patient's condition and life-history on the one hand, and the available information about the construction and validation of the test he has used on the other. Nor does it mean that the psychologist may not frequently find himself unable to test rival hypotheses; even in such circumstances he might not, in fact, use the principle of parsimony. His choice of hypothesis may not depend so much on which hypothesis has the smallest number of variables; but the hypothesis which, while explaining the largest number of facts, also enables the psychiatrist to make a disposal which is administratively convenient; or which, say, best suits the patient's personal situation. The principle of parsimony, therefore, is a relative one, and the way it is used depends on the purpose of the psychologist. It is not a principle which must necessarily yield the truth in a situation where few of the relevant facts have been established.

3. *The Abandonment of the "Artistic" Approach.*

Many psychologists insist that the clinical method is something different from the ordinary methods of science. For example, T. G. Andrews (1) states: "the clinical methods have a different frame of reference from the experimental and differential methods of psychology." For further definition of this third method he refers the reader to the article in this book by the late Andrew Brown (2).

While in most respects the description of the work of the clinical psychologist in this article is apposite, to talk as it does of the "art" of clinical work as one of its essential characteristics is to lay oneself open to many dangers. Such an approach is, in effect, a way out for those who will not or cannot make their hypotheses explicit and who avoid seeking rigorous tests of such hypotheses. It is, of course, legitimate to decide to work on the basis of a certain assumption with a patient because the patient's condition urgently demands action and the psychologist or psychiatrist knowingly takes a step into the dark. There are relative degrees of certainty with which one can entertain theories about a patient's condition and what can be done about it. However, it should always be possible to formulate in advance the possible outcome of one's theories, so that the actual can be compared with the predicted outcome. The fact that the applied scientist has often to plunge into guesswork and trial and error does not warrant the description of his work as being essentially an art, or a matter of intuition. To insist on something more than

science, rather than admitting plain but explicit guesswork, or to make a virtue of the fact that as yet we do not understand the processes of creative thinking, is to guarantee confusion, even though brilliant discoveries might be made in the course of such work. The onus still remains with the psychologist to use his ingenuity to make his thinking and procedures explicit, so that he formulates tests of his hypotheses and increases the efficiency of his work and enables others to learn from his failures and successes.

4. *Qualifications of the Goldstein-Scheerer Approach.*

Goldstein and Scheerer (5) state that "a patient might produce a minus result on a subtest without the function presumably tested by the applied subtest necessarily being lacking, and he might produce a plus result without the function presumably being tested necessarily being present." They state that this happens very frequently, and they give two examples which are worth examining. The first is that of a patient with an apparent alexia. When, however, a frame is placed around a word, that word is correctly perceived. Another example is that of a patient who was unable to do a sentence-completion test on one day but did a different sentence-completion test perfectly on a subsequent day. The explanation advanced for this finding is that on the second occasion the sentence which had to be completed had a personal bearing on the patient's present situation, whereas in the first test the content had no bearing whatever. They conclude, therefore, that the first failure was not due to a real inability to do sentence completion, and that therefore a zero score would have been misleading.

This point of view, and the examples given, are in agreement with one of the main theses of this article, i.e., that the test score does not necessarily indicate the patient's true standing on the function which it is supposed to measure. This fact does not justify Goldstein and Scheerer's conclusion that quantitative scoring and qualitative analysis are methodologically opposed.

First of all, ordinary quantitative methods are inherent in the examples quoted. The patient in fact scores zero in one kind of situation and full marks in another, and the discrepancy is probably statistically significant.

Once such a discrepancy has been observed an explanation has to be found. Goldstein and Scheerer put forward their own explanations, but they are not necessarily the only explanations that could be put forward, and not necessarily correct. These explanations would have to be validated by experiment.

In the light of these considerations one would therefore not pose the qualitative against the quantitative approach to diagnostic work. Quantification is usually necessary for exact observation, while qualitative analysis is always necessary in the development of hypotheses to account for one's observations. In any case, the demand for validation can never be avoided.

H. OBSTACLES IN THE WAY OF DEVELOPING NEW PROCEDURES.

It is one thing to point out the snags in a well-established procedure, and the general lines along which they might be overcome. It is another thing to carry out such a line in practice. In fact, in the field of diagnosis the method of the experimental investigation is almost non-existent. The application

of test methods for measuring the course and effects of treatment and in the disposal of patients has hardly yet begun. Among the obstacles to an effective development of the quality of the work, the most important would seem to be pressure from immediate colleagues, general shortage of time, and, perhaps, psychologists' own attitudes of mind.

1. *Pressure from Colleagues.*

There is considerable pressure from psychiatrists and social workers for quick and understandable results which serve as a short cut in the solution of difficult problems. There is a standing temptation for the psychologist to answer a query with "Yes, certainly. I'll give him the such-and-such and the so-and-so tests." His colleagues need not know that the standardization and the validation of these tests are practically non-existent; and that, in fact, in this particular case no test can be a substitute for a careful investigation of the patient's school and work history, which should be evaluated by someone trained in educational and industrial psychology.

2. *Understaffing.*

A second factor is the shortage of time. It is sometimes necessary to spend 30 hours on a patient before the main questions can be answered. The premium on time is due mainly to the large case loads and the relative understaffing of psychological departments. Until psychological departments are increased, it is necessary to review some of the more time-consuming traditions, such as that of the Binet for children and the apparently unqualified virtues of "individual" testing for all patients. Psychologists and psychiatrists need to review very critically the way they conduct their work, and to what extent the time spent on patients answers real questions. It may well be that the best approach consists of putting patients through a few strategically chosen group tests carried out by non-psychologists, so that the psychologist can devote time to intensive work on individual patients, or on fundamental research.

3. *Misconceptions.*

A third obstacle has been that of the attitude of mind of many clinical psychologists. One attitude implies that there is no scientific method of dealing with diagnostic problems other than that of the standardized validated test.

Psychologists who share this belief fall into two main categories. First, there are those who appear to believe that the only descriptive and diagnostic service that the psychologist has to offer is the provision of a test result. Secondly, there are those who are impelled by the limitations of routine testing to justify less scientific methods of approach. It is obvious that neither category is likely to play a vigorous part in the development of diagnostic experiments.

A second factor which hinders many clinical psychologists is a misunderstanding of the effect of multiple causation. They believe it is impossible, for

example, to find out by experiment why a patient cannot read, because of the multiplicity of factors which can produce a reading disability in a given case. The "causes" one looks for, however, depend on one's purpose. With a non-reader, for example, the main question is what is preventing him from reading *now*. One likely hypothesis is that he now has no physical or cognitive handicaps. This hypothesis can be tested by actually teaching him to read. If he succeeds in learning to read, then it would not be sensible to be paralysed by the fact that one cannot unravel the network of causes which prevented the patient from learning to read in the past.

This does not mean that the findings of large-scale investigations should be neglected, since they provide the basis for formulating hypotheses about a given patient and for developing long-term plans for preventive measures. The main point for the clinician is that the data provided do not necessarily give an answer to the question of why a given patient cannot read, nor do they exclude the possibility of finding an answer to such a question.

The main consequence of these difficulties appears to be a relative lack of integration between general psychology and clinical psychology. The clinical psychologist does not find himself forced to apply what he knows of the processes of perception, learning, thinking and feeling to his work. There is no intense process of mutual enrichment between general and clinical psychology. It is only occasionally, as in the work of Bender and Teuber, Gelb and Goldstein, that a two-way relationship between general and clinical psychology is shown.

I. DISCUSSION.

It must not be assumed that the experimental approach has not featured in both the writings and the work of many clinical psychologists. Most of the prominent psychologists working in this field have in one way or another described this approach, and every psychiatrist and neurologist uses this method in some way or other.

The Goldstein-Sheerer Monograph (5) gives examples of control experiments—for example, in the Colour-Form and Object-Sorting tests, which are implicitly based on the same principles as those described in this article. In his book Goldstein (4) suggests that the examination of patients should be taken to the point where "we can predict with relatively great certainty how he (the patient) will behave in any situation, even in respect to tasks which we have not yet examined. Only cases which have been investigated with such thoroughness should be used in the formation of a theory." A rather similar point is made by Schafer (8) when he says: "an *interpretation* is a prediction that certain phenomena of behaviour or thinking will be found by direct observation to characterize the subject. . . . An interpretation should be subject to immediate validation by refined observation. One implication of this definition must be stressed: the prediction must deal with a *characteristic*, with a mode of behaviour or thinking that is enduring and that sets the subject off from many or most other subjects."

Rosenzweig (7), too, states that there are conditions when he would formulate and test hypotheses about a patient. This is when the "insightful com-

prehension demanded of the clinician cannot be achieved." He concludes, "every individual becomes a research project in his own right."

In Zubin's (9) article in T. G. Andrews' *Methods of Psychology* there is given an example of the experimental investigation carried out on an hysteric, though the purpose of this experiment was not a diagnostic one.

In general, one can say that there is nothing new in the idea of the use of experimental method for diagnostic purposes. All that can be said to be new in this presentation is that experimental method is made the main approach to all diagnostic problems, and the standardized validated test thus takes its place as one very important method of testing hypotheses.

J. CONCLUDING SUMMARY.

This article was concerned with the discussion of only one aspect of the work of the clinical psychologist: the use of psychological tests for diagnostic purposes.

It discussed the needs which give rise to the use of the standardized validated test, and the difficulties that arise when the results are being evaluated.

The main thesis put forward was that the difficulties can, to a large degree, be met by making explicit the principles underlying all clinical investigations and that these principles are those of experimental method. Psychological tests, therefore, can be seen as one method, but not the only one, of testing hypotheses about a patient.

My thanks are due to Mr. A. Lubin and Dr. J. G. Ingham for their interest and criticisms.

REFERENCES.

- (1) ANDREWS, T. G., *Methods of Psychology*, 1948. London: Chapman & Hall, Ltd.
- (2) BROWN, ANDREW W., "Methods and Techniques in Clinical Psychology," in Andrews, T. G., *Methods of Psychology*.
- (3) DEARBORN, WALTER F., and ROTHNEY, JOHN W., *Predicting the Child's Development*, 1941. Cambridge, Mass.: Sci. Art Publishers.
- (4) GOLDSTEIN, KURT, *The Organism*, 1939. New York: Amer. Book Co.
- (5) *Idem* and SCHEERER, MARTIN, "Abstract and Concrete Behaviour," *Psychol. Monograph*, **53**, No. 2.
- (6) MCNEMAR, Q., *The Revision of the Stanford-Binet Scale*, 1942. Boston: Houghton Mifflin Co.
- (7) ROSENZWEIG, S., *Psychodiagnosis*, 1949. New York: Grune & Stratton.
- (8) SCHAFER, R., *The Clinical Application of Psychological Tests*. Menninger Foundation Monographs, No. 2.
- (9) ZUBIN, J., "Objective Studies of Disordered Persons," in Andrews, T. G., *Methods of Psychology*.

THE PROBLEM OF "ORALITY" AND OF ITS ORIGIN IN EARLY CHILDHOOD.

By FRIEDA GOLDMAN-EISLER, Ph.D.,

Department of Psychology, Institute of Psychiatry (Maudsley Hospital).

INTRODUCTION.

THE concept of "orality" as used in this paper indicates a certain constellation of traits or habitual reactions which are, or are assumed to be, derivatives, whether direct or modified, of behaviour patterns characteristic of early childhood. The importance of the mouth as the first erotogenic zone and as the organ generating fundamental attitudes of giving or receiving, waiting or being impatient, and hoping or despairing, has been stressed by psycho-analysis. According to psycho-analytic theory, the oral phase, that is, the first period of libidinal development, plays a most important part for later character development in as far as gratification, or frustration, of the oral impulses is assumed to have a determining influence on character-formation in later life.

I. SUMMARY OF PREVIOUS WORK.

This hypothesis was put to the test by the writer, and some of the results of this work have been reported with the full details of the investigation in two previous articles (3, 4) which are summarized below.

The investigation proceeded in two steps :

(a) Working out the diagnostic tool by which syndromes or oral character traits corresponding to those described by psycho-analysts might be detected, and (b) relating these to the subjects' date of weaning.*

PART I.—THE SYNDROMES OF ORAL PESSIMISM AND ORAL OPTIMISM.

To carry out the first of these steps, verbal rating scales for 19 traits mentioned by psycho-analytic writers as having an oral connotation were administered to 115 adult subjects. These traits were : optimism, pessimism, exocathexis, endocathexis, nurturance, passivity, sociability, aloofness, oral aggression, autonomy, aggression, guilt, dependence, ambition, impulsion, deliberation, change, conservatism, unattainability. They are given in full in the Appendix, together with definitions of the trait names, and the coefficients of their respective reliabilities and of the internal consistency of each item. A type pattern or ideal character profile was then set up in the following manner.

After computing from standardized test measurements the correlation of each of the traits with all others, an intercorrelation table was arranged with optimism at the one end of the list of traits and pessimism, which had meaningfully the highest negative correlation at the other end (see Table I).

* This was obtained by asking the subjects' mothers at what age (in terms of months) the subjects had been finally taken off the breast.

A type pattern was set up, conforming to the two antithetical clusters which emerged from the intercorrelation table: optimism, exocathexis, nurturance, sociability, and ambition correlating positively at one end of the distribution, and pessimism, passivity, aloofness, endocathexis, autonomy, and oral aggression constituting the opposite pole. The persons whose measurements corresponded most closely to the above clusters were selected, whether their scores on optimism and the related traits were positive, and those on pessimism and its correlates negative, or the other way round. Those who showed positive scores for the first group of traits were called "oral optimists," and those who showed positive scores for the second group of traits "oral pessimists." In this way twenty "oral optimists" and twenty "oral pessimists" were selected, the qualification for these categories being that their scores should show at least 8 out of the 11 characteristic traits clustering in the expected antithetical direction. The scores for the 20 "oral pessimists" and the 20 "oral optimists" were then totalled—after the signs of the optimists had been reversed—and averaged.

The measurements (in standard units) which appear in column I and II of Table II are presented graphically in Diagram I. The standard measures

TABLE II.

Traits.	I. Upper group (Pessimists).	II. Lower group (Optimists).	III. In standard measure.	
			Total.	Average.
Pessimism . . .	+1.417	-0.894	+46.23	+1.155
Passivity . . .	+0.966	-1.134	+42.01	+1.050
Aloofness . . .	+0.826	-0.685	+30.23	+0.755
Oral aggression . . .	+0.862	-0.335	+23.94	+0.598
Endocathexis . . .	+0.687	-0.485	+23.44	+0.586
Autonomy . . .	+0.919	-0.234	+23.08	+0.577
Aggression . . .	+0.445	-0.339	+15.69	+0.392
Guilt . . .	-0.025	-0.587	+11.23	+0.280
Dependence . . .	+0.364	-0.151	+10.31	+0.257
Conservatism . . .	+0.135	-0.167	+6.06	+0.151
Unattainability . . .	-0.052	+0.204	+5.13	+0.128
Impulsion . . .	+0.194	+0.337	+2.86	+0.071
Deliberation . . .	-0.092	-0.072	-0.40	-0.010
Change . . .	-0.091	+0.395	-9.74	-0.243
Ambition . . .	-0.309	+0.223	-10.66	-0.266
Sociability . . .	-0.695	+0.536	-24.63	-0.615
Nurturance . . .	-0.958	+0.611	-31.38	-0.784
Exocathexis . . .	-0.952	+0.701	-33.07	-0.826
Optimism . . .	-1.192	+1.086	-45.57	-1.139

at the scale on the left express the saturations of the type with the traits. The relative symmetry of the two graphs or profiles supporting the assumption that the traits form a bipolar syndrome seemed to justify the pooling of the two groups.

This procedure may be criticized on the ground of what might be called its impurity of method. If the aim of the investigation was to test a psycho-analytic hypothesis, namely the relation of oral character types to weaning, it would have been more strictly logical to set up the ideal or hypothetical profile which was to serve as the criterion of orality, without reference to the actual intercorrelation table, but directly from psycho-analytic description.

However, there were difficulties in the way of following this course. For although psycho-analytic writers agree with respect to the basic oral traits different writers put different emphasis on different traits or combinations of traits. Syndromes are sometimes suggested, but on other occasions traits are enumerated singly without a clear idea being given of how they combine, or whether in fact they invariably do combine. Moreover, the psycho-analytic theory is phrased in a descriptive and qualitative form, so that it was still incumbent upon the investigator to find its quantitative expression. Thus,

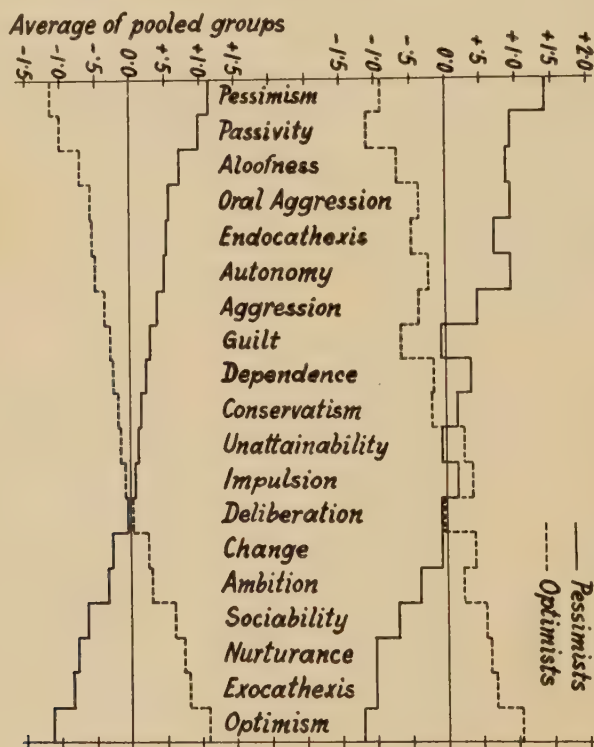


DIAGRAM I.—Upper part: Trait profiles derived from the measurements of 20 Pessimists and 20 Optimists. Lower part: Ideal type profiles of oral Pessimism-Optimism based on the measurements of the pooled groups. Scale in standard measures.

while psycho-analytic literature was responsible for the selection of the particular traits tested, their quantitative expressions have emerged from the intercorrelations of tests. As it happened these were very much, though not entirely, what one would have expected on the basis of the theory. Indeed, when the type pattern extracted in this way, both for oral pessimism or, conversely, oral optimism, was compared with the orally gratified and the orally ungratified types as described by psycho-analytic writers, a close correspondence was found. A detailed juxtaposition of the test results with the psycho-analytic theory is to be found in a previous article (3). All test measurements, except those for impulsion, deliberation and unattainability, were in the

expected direction. In particular those traits which had impressed themselves on psycho-analysis as of oral origin most clearly, namely excessive optimism or alternatively pessimism, the passive-receptive attitude (tests : passivity, neg. nurturance) ; narcissism (tests : aloofness, autonomy) ; and generosity (test : nurturance) were represented by the highest quantitative assessments (see Table II).

PART 2.—BREAST-FEEDING AND ORAL PESSIMISM-OPTIMISM.(4)

The assumption of an oral history underlying the oral character was tested in the following way : Each subject's test scores on the 19 traits were correlated with the "ideal" type profile, and this correlation coefficient, indicating the degree of correspondence of this individual's own profile to the type profile, was taken as his score in oral pessimism (or optimism). An analysis of variance was then carried out comparing the scores in oral pessimism of those who had been weaned early (i.e., not later than four months of age) with those who had enjoyed breast-feeding for a longer period. (The choice of the critical period of four months was suggested by the observations of Margaret Ribble (5), who had found that infants adjusted considerably better to deprivation after than before this date). The mean score in oral pessimism for the early-weaned group was $+0.139$, and for those weaned later -0.181 . The difference was significant beyond the 1 per cent. level of probability. The correlation between early weaning and pessimism was $.271$, and when the early weaners were compared only with those who had enjoyed a full measure of breast-feeding, i.e., nine months and more, it was $.305$; when they were compared with those who had enjoyed an excessive period of breast-feeding, i.e., more than nine months, it was $.368$, the scores in oral pessimism of the early weaners being $+138$, and of the excessive feeders -346 .

While the above results confirm the psycho-analytic theory of oral character types in most of its essential aspects, one important characteristic, the significance of which as an oral trait ranks extremely high in psycho-analytic literature (1, 2), forms an exception. This is the trait of impatience, measured in this investigation by the scales of impulsion, and, negatively, deliberation. These two scales make practically no contribution to the oral pessimist type profile, and the intercorrelation table of traits shows that it is outside the optimist or pessimist clusters. Its independence suggested a second bipolar factor, and the table was therefore submitted to a factor analysis (simple summation method). Two factors were extracted and their saturations with each of the 19 traits are given in Table III. The two columns of saturations are plotted in Diagram II.

The first factor corresponds to the type profile of oral pessimism and correlates with it $.694$. It differs from it in as far as factor I is most highly saturated with aloofness, which is only third in importance in the type ; and passivity takes fourth place as against second place in the type. Moreover oral aggression and autonomy, which were fourth and sixth place respectively in the trait hierarchy of the type, move to tenth and eleventh place, thus contributing little to the factor. (We shall see below that these latter traits appear prominently in factor II.)

An analysis of variance discriminating between the two groups of early and late weaned subjects on the basis of factor scores of this first factor showed the difference to be significant beyond the 1 per cent. level of probability. The correlation between weaning and factor I being .287 as against .27 for the

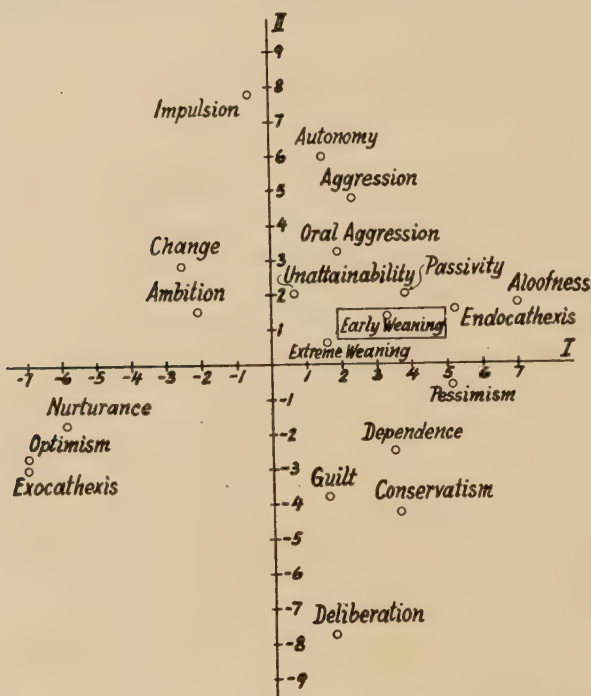


DIAGRAM II.—Plot of the factor loadings of 19 tests with reference to factor axes I and II.

TABLE III.

	F ₁ .	F ₂ .		F ₂ .
Aloofness	.709	.164	Impulsion	.782
Endocathexis . . .	.513	.160	Autonomy	.600
Pessimism	.501	-.059	Aggression	.476
Passivity	.387	.204	Oral aggression . .	.318
Conservatism . . .	.353	-.438	Change	.275
Dependence	.347	-.244	Passivity	.204
Early weaning . . .	.337	.129	Unattainability . .	.201
Aggression	.235	.476	Rejection	.164
Oral aggression . .	.193	.318	Endocathexis . . .	.160
Deliberation . . .	.178	-.776	Ambition	.139
Extreme weaning (early and very late) . .	.167	.059	Early weaning . . .	.129
Guilt	.163	-.376	Extreme weaning . .	.059
Autonomy	.150	.600	Sociability	-.012
Unattainability . .	.054	.201	Pessimism	-.059
Impulsion	-.052	.782	Nurturance	-.184
Ambition	-.219	.139	Dependence	-.244
Change	-.253	.275	Optimism	-.280
Sociability	-.489	-.012	Exocathexis	-.297
Nurturance	-.585	.184	Guilt	-.376
Optimism	-.694	-.280	Conservatism	-.438
Exocathexis	-.701	-.297	Deliberation	-.776

type pattern showed that the factor gave only an insignificantly better prediction than the type.

II. FACTOR II OF IMPATIENCE-AGGRESSION-AUTONOMY AND ITS RELATION TO BREAST-FEEDING.

Our main interest in this paper, however, belongs to factor II. A person who would be highly saturated with this factor would be characterized by extreme impulsiveness and a disinclination to wait or refrain from action (impulsion, $\cdot 761$; deliberation, $-.766$), by independence or a disinclination to conform (autonomy, $\cdot 560$), by aggression, general and oral (aggression, $\cdot 479$; oral-aggression $\cdot 303$), and by a tendency to change, to seek the new, rather than to stick to the well-known and familiar (change, $\cdot 267$; conservation, $-.436$). Aloofness ($\cdot 234$), passivity ($\cdot 214$), the desire for the unattainable (unattainability, $\cdot 209$), and withdrawal (endocathexis, $\cdot 160$; exocathexis, $-.316$) also contribute to the syndrome but to a much smaller extent. Pessimism plays an insignificant role in this factor. Recalling psycho-analytic writers on the subject, particularly Abraham and Glover, there is no doubt that a person like the one described above contains in his personality what these writers considered to be essential aspects of the oral character. None of the psycho-analytic writers have, however, discriminated between two different and independent oral syndromes as are suggested by our two independent factors, although there are implicit suggestions of an active reaction as compared with a passive submission to oral frustration (1).

The question remains to be answered what the relation of factor II to oral frustration is. The idea that "oral frustration, oral impatience, oral sadism, are inseparable" (6) is a firmly entrenched tenet of the psycho-analytic theory of orality. As factor II is highly loaded with impatience (impulsion) and aggression (sadism), its relation to weaning (if early weaning be taken as a measure of oral frustration) should demonstrate with what degree of confidence such a statement as the above may be made. Again factor scores were computed, showing the degree with which each individual was saturated with factor II, and the two weaning groups compared for differences. Although the differences were in the expected direction, those subjects who had been weaned early having a mean factor score of $\cdot 0344$, and those weaned late (after four months of breast-feeding), a mean factor score of $-.0234$, the analysis of variance showed that these differences were not significant; nor were the differences between the early weaned subjects and those who had been given breast-feeding for nine months and longer. In other words, our data do not confirm the psycho-analytic contention that oral frustration, impatience and oral aggression are inseparable or even related. Clearly early weaning seems to have not nearly as much bearing on the impatience-aggression syndrome as it had on the syndrome of pessimism, passivity, aloofness and endocathexis.

However, a hypothesis treated as a fact by so many careful and highly trained (although of course also highly indoctrinated) observers, and stated again and again with the utmost confidence, must still command attention. A further analysis of the data was therefore undertaken. This analysis was

based on factor scores of oral pessimism (factor I). The sample was divided into four groups: impulsive and early weaned, non-impulsive and early weaned, impulsive and late weaned, and non-impulsive and late weaned subjects. Those who had scores on factor II higher than .200 were apportioned to the impulsive group; those whose factor scores were below .200 to the non-impulsive. Late weaning was weaning after a period of breast-feeding lasting four months. The mean scores of oral pessimism for each of these groups are given below:

	Mean.	Numbers in group.
Early impulsive	516.7	8
Early non-impulsive	427.7	22
Late impulsive	413.6	11
Late non-impulsive	341.2	49

An analysis of variance was carried out comparing the differences between these groups. The F-ratio was 4.38, significant at the 1 per cent. level of probability. T-tests were then calculated in order to compare the individual groups. Table IV shows the results.

TABLE IV.—*Analysis of Variance testing the difference between early weaned impulsive, early weaned non-impulsive, late weaned impulsive, and late weaned non-impulsive subjects with respect to oral pessimism (factor I).*

Source.	Degrees of freedom.	Sum of squares.	Mean square.
Between groups	3	281,657.5	93,885.8
Within groups	86	1,843,670.9	21,438.0
	89	2,125,328.4	

$$F = 4.38 \text{ (F for 3 and 80 df. at 1 per cent. level} = 4.04.$$

T-tests.

	Early impulsive.	Early Non- impulsive.	Late impulsive.	Late Non- impulsive.
Early-impulsives	..	..	..	..
Early non-impulsives	1.47	..	..	..
Late impulsives	1.52	0.26	..	..
Late non-impulsives	3.14*	2.30†	1.48	..

* Significant at the 1 per cent. level.

† Significant at the 5 per cent. level.

The greatest difference, significant at the 1 per cent. level, can be observed between the early-impulsive and the late non-impulsive group, and the difference between the early impulsive and late impulsive groups is significant at the 5 per cent. level. These, one might argue, are the differences between early and late weaning, quite independent of any effect of the factor of impulsiveness. This, however, does not explain the following features in the above array: (a) that no significant difference exists between the early non-impulsive and the

late impulsive group, and (b) the consistency of the decrease in oral pessimism as the scale moves from those who are impulsive as well as early weaned towards those who are neither.

For the purpose of further clarification, frequency distributions for the early and late weaning groups were plotted along the oral pessimism scale of factor I, saturations showing the location on this scale of the members of the impulsive groups of early as well as of late weaners (Diagram III). From these we can see that of the eight impulsive subjects in the early weaning

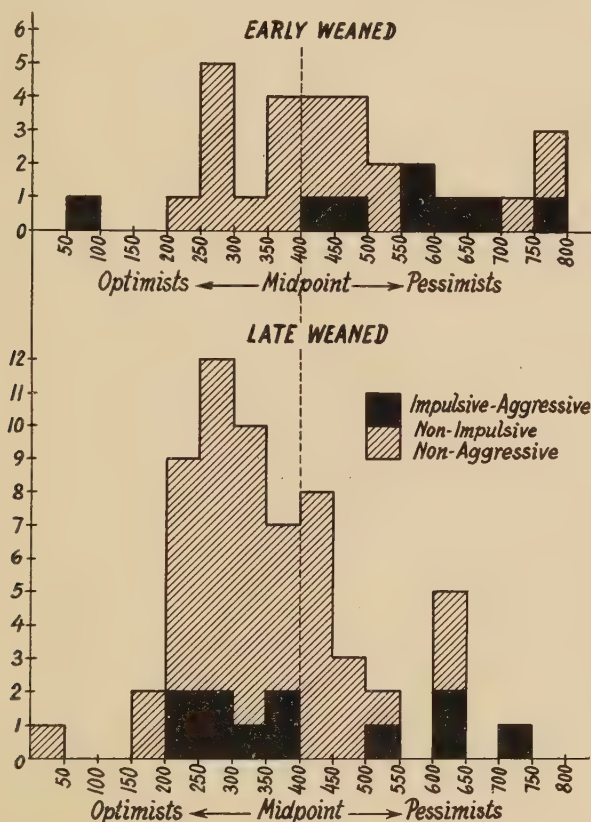


DIAGRAM III.—Frequency distribution for early and late weaning groups plotted along the Oral Pessimism scale of factor I.

group, seven are above the mid-point of oral pessimism. (It may be noted that the one who is not is an extreme optimist.) The distribution of late weaners, on the other hand, shows the impulsive subjects to be distributed all along the scale from optimism to pessimism.

The proportions of impulsive and non-impulsive subjects in the two weaning groups and in the total sample are presented in Table V. From this it may be seen that among those who had been weaned early, the proportion of pessimists, with an impulsive and aggressive personality, to optimists of the same disposition, was 7 : 1 ; while the ratio of pessimists to optimists among those

TABLE V.

	Early weaned.		Early weaned total.	Late weaned.		Early weaned total.	Bottle-fed.		Bottle-fed total.	Total sample.
	Pessimists.	Optimists.		Pessimists.	Optimists.		Pessimists.	Optimists.		
Impulsive :	.	7	8	.	4	11	3	1	4	23
Non-impulsive :	.	11	22	.	15	49	2	4	6	77
Sums.	.	18	30	.	19	60	5	5	10	100

with a placid disposition (non-impulsive, non-aggressive) was 11 : 11 or 1 : 1. No such contrast exists among the group of subjects who had enjoyed long breast-feeding, testifying to the fact that over the whole sample the two factors of oral pessimism and impulsion-aggression are independent.

Whether this relatively greater predominance of early weaned oral pessimists over optimists among the impulsive-aggressive individuals (7 : 1), as compared with the equal balance of the same types among placid individuals (11 : 11), is a matter of chance, or has any significance, is a question which must be left to a further investigation ; the above numbers are too small to justify any conclusion. A suggestion emerges from our samples that there may be two types of early weaned pessimists : one who is aggressive at the oral level, impulsive, and also generally aggressive, and the other who is neither particularly aggressive nor impulsive. The former corresponds much more closely to the classical conception of the aggressive, impatient, dissatisfied oral character as described by Abraham and Glover (1, 2) than does our original oral pessimist type profile.

The emphasis in psycho-analytic literature on the impulsive-aggressive oral pessimist may possibly be due to the fact that this type of person being the more active will more frequently be found in the psycho-analytic consulting room than the orally unaggressive individual.

SUMMARY.

1. Previous work was summarized showing that a type pattern derived from 19 trait scales and corresponding to the syndrome of oral pessimism as described by psycho-analytic writers was significantly related to early weaning, oral optimism being significantly related to late weaning.

2. The 19 traits measured were : optimism, pessimism, exocathexis, endocathexis, nurturance, passivity, sociability, aloofness, oral aggression, autonomy, aggression, guilt, dependence, ambition, impulsion, deliberation, change, conservatism, unattainability.

3. An intercorrelation table based on the trait scores of a hundred subjects was computed and submitted to a factor analysis. Two factors were extracted.

4. Factor I corresponded in most aspects to the syndrome of oral pessimism as described by psycho-analysts, and correlated .694 with the previously derived type pattern. It was, however, poorly saturated with impulsion, aggression and autonomy, which psycho-analysts consider to be important traits of oral character. It was significantly related to early weaning.

5. Factor II was highly saturated with impulsion, aggression and autonomy. It was not significantly related to early weaning.

6. Individuals who had high scores on factor II and who had been weaned early had significantly higher scores on factor I (oral pessimism) than the rest of the sample.

7. A suggestion to be investigated emerges that the concurrence in an individual of early weaning and of the characteristics of impulsiveness-aggression-autonomy, as defined in factor II, may possibly promote the development of oral pessimism.

REFERENCES.

- (1) ABRAHAM, K., "The Influence of Oral Eroticism on Character-formation," in *Selected Papers*, 1942. London: Hogarth Press.
- (1a) BERGLER, E., "Zur Problematik des Oralen Pessimisten," *Imago*, 1934, **20**, 330-376.
- (2) GLOVER, E., "Notes on Oral Character-formation," *Int. J. Psychoanal.*, 1925, **6**, 131-153.
- (3) GOLDMAN, FRIEDA, "Breast-feeding and Character-formation," *J. Personality*, 1948, **17**, 83-103.
- (4) *Idem*, "The Etiology of the Oral Character in Psycho-analytic Theory," *ibid.*, 1950, **19**, 189-196.
- (5) RIBBLE, MARGARET M., "Infantile Experience in Relation to Personality Development," in J. McV. Hunt (Ed.), *Personality and the Behavior Disorders*, 1950, vol. 2, 621-651. New York: Ronald Press Co.
- (6) SHARPE, ELLA "Hamlet", in *Collected Papers on Psycho-analysis*, 1950. London: Hogarth Press.

APPENDIX.

The Traits.

(Reliability coefficients are presented in parentheses following the description of each trait.)*

Optimism.—Optimism and pessimism are antithetical expressions in character-formation of an omnipotent and magical relation to reality. Optimism deriving from this unconscious source would be upheld by the individual against reasonable expectation. ($r = .90.$)

Pessimism : Inability to accept frustrating experiences as part of reality. Defence against disappointments through summary and advance resignation, anticipation of disappointment. ($r = .74.$)

Passivity : Passive-receptive attitude, hedonism, indolence, self-indulgence. ($r = .81.$)

Desire for the unattainable : Intense desire to climb combined with a feeling of unattainability, of difficulty in achievement, of the insuperable, grudging incapacity to get on. ($r = .78.$)

Displaced oral aggression (verbal) : Aggressive use of speech, "omnipotent valuation of speech," "incisive speech." Question 7, although not referring to speech but to the oral expression of rage or the motor accompaniments of oral activity, was included in this scale.

Its correlation of $+ .52$ with the total score of the scale seems to confirm that there is a common factor operating in primary oral aggression and aggressiveness in speech. ($r = .76.$)

Aggression : The desire to injure or inflict pain, to overcome opposition forcefully, to fight, to revenge an injury, to attack, to oppose forcefully ($r = .78.$)

Aloofness : Negative tropism for people, attitude of rejection. ($r = .73.$)

Ambition : Tendency to overcome obstacles, to exercise power, to strive to do something difficult as well and as quickly as possible, to attain a high standard, to excel one's self. ($r = .68.$)

Autonomy : Those who wish neither to lead nor to be led, those who want to go their own way, uninfluenced and uncoerced. Independence of attitude. ($r = .88.$)

Dependence : Tendency to cry, plead or ask for nourishment, love, protection or aid. Helplessness, insecurity. ($r = .56.$)

Guilt : "Conscience," inhibiting and punishing images, self-torture, self-abasement. ($r = .90.$)

Change : A tendency to move and wander, to have no fixed habitation, to seek new friends, to adopt new fashions, to change one's interests and vocation. Inconsistency and instability. ($r = .71.$)

Conservatism : Adherence to certain places, people, and modes of conduct. Fixation and limitation. Enduring sentiments and loyalties, persistence of purpose; consistency of conduct; rigidity of habits. ($r = .56.$)

* The reliability of each scale was measured by the split-half method of correlating odd and even numbered items and corrected by the Spearman-Brown prophecy formula.

Impulsion : The tendency to act quickly without reflection. Short reaction time, intuitive or emotional decisions. The inability to inhibit an impulse. ($r = .82$.)

Deliberation : Inhibition, hesitation and reflection before action. Slow reaction time, compulsive thinking. ($r = .87$.)

Exocathexis : The positive cathexis in practical action and co-operative undertakings. Occupation with outer events: economic, political and social occurrences. A strong inclination to participate in the contemporary world of affairs. ($r = .72$.)

Endocathexis : The cathexis of thought or emotion for its own sake. A pre-occupation with inner activities, feelings, fantasies, generalizations, theoretical reflections, artistic conceptions, religious ideas; withdrawal from practical life. ($r = .73$.)

Nurturance : Tendency to nourish, aid, and protect a helpless object. To express sympathy, to mother a child, to assist in danger. ($r = .79$.)

Sociability : Tendency to form friendships and associations; to join, and live with, others. To co-operate and converse socially with others. To join groups. ($r = .70$.)

The rating scales for 19 character traits.

Optimism.

Rating scale.	Rel. coeff. $r = .90$.	r_t .*
1. Nothing is impossible to a willing heart		.74
2. In the end justice will prevail		.60
3. Every cloud has a silver lining!		.63
4. There is sure to be enough to go round		.92
5. Ill luck is good for something		.52
6. Atomic energy will bring progress and happiness to humanity		.54
7. Most people can be trusted		.47
8. The world is a wheel and it will all come round right		.73

Pessimism.

Rating scale.	Rel. coeff. $r = .74$.	r_t .
1. It is misery to be born, pain to live, grief to die		.76
2. Greed and lust are the most powerful motive forces of mankind		.44
3. Hardly anyone cares much what happens to you		.48
4. "Oh life! thou art a galling load Along a rough, a weary road"		.64
5. There is sure to be a snag somewhere		.41
6. Real friends are hard to find		.52
7. Accept the present evil, lest a greater one befall you		.53
8. Hope only brings disappointment		.58

Passivity.

Rating scale.	Rel. coeff. $r = .81$.	r_t .
1. It is better to sit still than rise and fall		.44
2. Oh, for a life of ease and luxury!		.00 ($\sigma = .41$)*
3. "An idle life is life for me, Idleness spiced with philosophy		.60
4. Good luck is more help than hard work		.65
5. Work has no place in paradise		.58
6. It is better to do nothing than make a mistake		.58
7. Comfort is indispensable for a contented life		.50
8. Competition is not for me; it irritates rather than stimulates me		.45

* The σ -coefficient is based on the correlation of the upper and lower quarters of the sample.

* Index of internal consistency measured by the tetrachoric correlation coefficient.

Desire for the Unattainable.

Rating scale.	Rel. coeff. $r = .78.$	r_{tt}
1. I like best that which flies beyond my reach		.55
2. I never get what I really want		.80
3. Other people seem to get away with things—I can't		.64
4. How seldom the goal is ever reached in human affairs		.42
5. I often think that other people are more lucky than I am		.38
6. The more you want something the less you get it		.76
7. To attain what we desire means also to realize the vanity of our wishes		.65
8. Life is a wild-goose chase.		.84
9. Dreams are the better part of life		.67

Displaced Oral Aggression (Verbal).

Rating scale.	Rel. coeff. $r = .76.$	r_{tt}
1. When your anger is aroused do you tend to express yourself in "strong" language?		.62
2. Do you like colourful invective?		.71
3. Do you tend to make biting or sarcastic remarks when criticizing other people?		.66
4. Do you find yourself frequently disagreeing with, and con- tradicting people?		.73
5. Are you fond of arguing?		.47
6. Do you like a debate to be hard-hitting?		.67
7. When in a rage do you tend to give motor expression to your feelings, such as stamping your feet, grinding your teeth, pushing your fist in your mouth, or biting your finger- nails or handkerchief or other objects, or breaking or tearing something?		.52

Aggression.

Rating scale.	Rel. coeff. $r = .78.$	r_{tt}
1. If somebody annoys you are you apt to tell him what you think of him?		.76
2. Do you try to get your own way regardless of opposition?		.57
3. If you come across a domineering person are you inclined to put him in his place?		.69
4. Do you often blame other people when things go wrong?		.66
5. Are you considered aggressive by some of your acquaint- ances?		.80
6. Are you apt to express your irritation rather than restrain it?		.78
7. Do you often let yourself go when you are angry?		.64
8. Are you apt to rebuke your friends when you disapprove of their behaviour?		.59

Aloofness.

Rating scale.	Rel. coeff. $r = .73.$	r_{tt}
1. Are you intolerant of people who bore you?		.55
2. Do you maintain reserve when you meet strangers?		.49
3. Do you get annoyed when your time is taken up by people in whom you are not interested?		.78
4. Do you avoid close intimacies with other people?		.58
5. Do you usually keep yourself somewhat aloof and inacces- sible?		.60
6. Have you frequently been reproached for your scornful manner in argument, particularly with people whose ideas you considered inferior to your own?		.70
7. Do you often tend to express your resentment against a person by having nothing more to do with him?		.55
8. Do you generally prefer the company of older, talented or generally superior people?		.53
9. Do you find the company of uninteresting people insufferable in the highest degree?		.71

Ambition.

Rating scale.

Rel. coeff. $r = .68$.

rt.

- | | |
|---|-----|
| 1. Do you feel that life can offer hardly any substitute for great achievement ? | .66 |
| 2. Are you rather set upon accomplishing some valuable piece of work some time in your life ? | .77 |
| 3. Does your admiration for certain great men inspire you to emulate them in one way or another ? | .78 |
| 4. Are you employing most of your energies in the pursuit of your career ? | .55 |
| 5. Do you feel that a far goal is deserving your efforts more than a daily duty ? | .72 |
| 6. Do you often dream about your future successes ? | .52 |
| 7. Would you say that ambition is a strong motive force in your life ? | .46 |

Autonomy.

Rating scale :

Rel. coeff. $r = .88$.

rt.

- | | |
|---|-----|
| 1. Do you feel that you cannot do your best work when you are in a subservient position ? | .52 |
| 2. Does it make you stubborn and resistant when others attempt to coerce you ? | .60 |
| 3. Do you often act contrary to custom or to the wishes of your parents ? | .70 |
| 4. Do you argue against people who attempt to assert their authority over you ? | .58 |
| 5. Do you try to avoid situations where you are expected to conform to conventional standards ? | .76 |
| 6. Do you go your own way regardless of the opinion of others ? | .62 |
| 7. Are you generally disinclined to adopt a course of action dictated by others ? | .55 |
| 8. Do you tend to disregard the rules and regulations that hamper your freedom ? | .74 |
| 9. Do you set independence and liberty above everything ? | .44 |
| 10. Are you apt to criticize whoever happens to be in authority ? | .54 |

Dependence.

Rating scale :

Rel. coeff. $r = .56$.

rt.

- | | |
|---|-----|
| 1. Do you usually tell your friends about your difficulties and misfortunes ? | .76 |
| 2. Do you think of yourself sometimes as neglected and unloved ? | .72 |
| 3. Are you rather easily discouraged when things go wrong ? | .80 |
| 4. Do you sound the opinions of others before making a decision ? | .66 |
| 5. Do you feel lost and helpless when you are left by someone you love ? | .46 |
| 6. Are you apt to complain about your sufferings and hardships ? | .72 |

Guilt.

Rating scale :

Rel. coeff. $r = .90$.

rt.

- | | |
|---|------------------------|
| 1. Do you tend to be rather submissive and apologetic when you have done wrong ? | .24 ($\sigma = .43$) |
| 2. Do you feel nervous and anxious in the presence of superiors ? | .53 |
| 3. Are you sometimes depressed by a feeling of your own unworthiness ? | .50 |
| 4. Do you often ask yourself : " Have I done right ? " | .73 |
| 5. Do you feel sometimes that people disapprove of you ? | .52 |
| 6. Are you frequently troubled by pangs of conscience ? | .60 |
| 7. Do you sometimes experience a vague feeling of anxiety as if you had done wrong and would be found out ? | .68 |

Change.

Rating scale :	Rel. coeff. $r = \cdot 71$.	r_t .
1. Do you like variety and contrast; always willing to welcome change?		$\cdot 50$
2. Do you frequently start new projects without waiting to finish what you have been doing?		$\cdot 50$
3. Do you find that novel prospects—new places, new people, new ideas—appeal strongly to you?		$\cdot 65$
4. Could you cut your moorings—leave your home, family and friends—without suffering great regret?		$\cdot 46$
5. Do you find that your likes and dislikes change quite frequently?		$\cdot 47$
6. Are you quick to discard the old and accept the new; new fashions, new methods, new ideas?		$\cdot 82$
7. Are you fickle in your affections?		$\cdot 52$
8. Have you often experienced rather marked swings of mood from elation to depression?		$\cdot 65$

Conservatism.

Rating scale :	Rel. coeff. $r = \cdot 56$.	r_t .
1. Are you somewhat disturbed when your daily habits are disrupted by unforeseen events?		$\cdot 62$
2. Do you find that you react with a certain resistance to untested innovations?		$\cdot 54$
3. Do you find that a well-ordered mode of life with regular hours and an established routine is congenial to your temperament?		$\cdot 82$
4. Can you endure monotony without much fretting?		$\cdot 73$
5. Do you prefer to associate with your old friends, even though by so doing you miss the opportunity of meeting more interesting people?		$\cdot 38$
6. Are you usually consistent in your behaviour, going about your work in the same way, frequenting the same preferred places, following the same routes, etc.?		$\cdot 64$

Impulsion.

Rating scale :	Rel. coeff. $r = \cdot 82$.	r_t .
1. Do you often act on the spur of the moment?		$\cdot 67$
2. Are you inclined to express your wishes without much hesitation?		$\cdot 49$
3. Do you often act impulsively just to blow off steam?		$\cdot 91$
4. Are you quick in commenting on most occasions?		$\cdot 48$
5. Do you often do a thing in a hurry just to get it over?		$\cdot 46$
6. When you have to act, are you usually quick to make up your mind?		$\cdot 42$
7. Do you sometimes start talking without knowing exactly what you are going to say?		$\cdot 68$
8. Are you easily carried away by an emotional impulse?		$\cdot 83$
9. Are you apt to say anything—though you may regret it later—rather than keep still?		$\cdot 78$
10. Would you call yourself spontaneous in speech and action?		$\cdot 74$

Deliberation.

Rating scale :	Rel. coeff. $r = \cdot 87$.	r_t .
1. Do you repress your emotions more often than you express them?		$\cdot 47$
2. Do you think much and speak little?		$\cdot 74$
3. Are you slow in deciding upon a course of action?		$\cdot 90$

4. Do you usually consider a matter from every standpoint before you form an opinion ?	·64
5. Are you slow to fall in love ?	·52
6. Do you usually make a plan before you start to do something ?	·45
7. When you are confronted by a crisis are you apt to become inhibited and do nothing ?	·43
8. Do you usually do things slowly and deliberately ?	·74
9. Do you dislike making hurried decisions ?	·59
10. Are you good at repartee, quick retorts, snap judgements ? (Neg.)	·46

Exocathexis.

Rating scale :	Rel. coeff. $r = \cdot 72$.	rt.
1. Do you find that you can deal with an actual situation better than cope with general ideas and theories ?		·62
2. Do you like being in the thick of action ?		·49
3. Do you like to do things with your hands ?		·62
4. Would you call yourself a practical person ?		·60
5. Would you rather take an active part in contemporary events than read and think about them ?		·71
6. Do you like to have people about most of the time ?		·66

Endocathexis.

Rating scale :	Rel. coeff. $r = \cdot 73$.	r_t .
1. Are you inclined to withdraw from any kind of action ?		$\cdot 34$ ($\sigma = \cdot 50$)
2. Do you prefer to know rather than do ?		$\cdot 57$
3. Do you spend a lot of time philosophizing with yourself ?		$\cdot 75$
4. Do you think more about your private feelings or theories than you do about the practical demands of every-day existence ?		$\cdot 78$
5. Would you rather write a fine book than be an important public figure ?		$\cdot 64$
6. Do you like above all to discuss general questions—scientific and philosophical—with your friends ?		$\cdot 45$
7. Are you more interested in aesthetic and moral values than in contemporary events ?		$\cdot 63$
8. Do you find at social gatherings that you don't seem to enjoy yourself as other people ?		$\cdot 53$
9. Are you apt to brood for a long time over a single idea ?		$\cdot 56$
10. Do you dislike everything to do with money—paying, selling, bargaining ?		$\cdot 34$ ($\sigma = \cdot 39$)

Nurturance.

Rating scale:	Rel. coeff. $r = \cdot 79$.	rt.
1. Are you drawn to people who are sick, unfortunate, or unhappy ?		$\cdot 78$
2. Do you feel great sympathy for any "underdog" and are you apt to do what you can for him ?		$\cdot 69$
3. Do you often go out of your way to feed, pet, or otherwise care for an animal ?		$\cdot 43$
4. Do you enjoy putting your own affairs aside to do someone a favour ?		$\cdot 68$
5. Are you considered, by some of your friends, as too good-natured, too easily taken in ?		$\cdot 53$
6. Do you enjoy playing with children ?		$\cdot 80$
7. Do you find it difficult to lend things (books, money, etc.) to other people ? (neg.)		$\cdot 55$

Sociability.

Rating scale :	Rel. coeff. $r = .70.$	$r_t.$
1. Do you make as many friends as possible and are always on the lookout for more ?		.83
2. Do you accept social invitations rather than stay at home alone ?		.78
3. Do you make a point of keeping in close touch with the doings and interests of your friends ?		.50
4. Do you go out of your way to be with your friends ?		.52
5. Do you feel that friendship is more important than anything else ?		.75
6. Do you enjoy yourself very much at parties and social gatherings ?		.74

ANOMALOUS PHYSICAL SIGNS OF BODILY DISEASE IN MENTAL DEFICIENCY.*

By BRIAN H. KIRMAN, M.D., D.P.M.

From the Fountain Hospital, Tooting.

It was recognized long before the birth of Freud and of psychoanalysis that the mental attitude of the patient has an important if not a decisive influence on the course of bodily disease. Milton expresses the almost universal striving for life in spite of the sufferings of illness when he says :

“ And that must end us : that must be our cure—
To be no more. Sad cure ! for who would lose,
Though full of pain, this intellectual being,
Those thoughts that wander through eternity,
To perish rather, swallowed up and lost
In the wide womb of uncreated Night,
Devoid of sense and motion ? ”

In more recent times, almost the whole of the work of Pavlov (1928), and particularly that of his pupil Bykov, is devoted to emphasizing the role of the cortex and higher brain centres in the determination of bodily reactions.

It would therefore be surprising if in those idiots whose condition approaches the decerebrate state, who are in fact almost anencephalic, the physical signs of bodily disease were not anomalous. The following pictures illustrate the extreme poverty of brain tissue which may exist in the severe forms of mental deficiency. In Fig. 1 is shown a marked case of microcephaly, and in Fig. 2 a brain from a similar case weighing only 315 gm. as compared with an average weight of 900 gm. (age 6). Admittedly the performance of the brain should not be judged by weight alone, and it may be recalled that that of Anatole France is quoted as an example of quality rather than quantity. However, it is clear that in the case illustrated higher cerebral functions must be virtually non-existent. Particularly is this so when it is remembered that the brain in microcephaly is deficient qualitatively as well as quantitatively, and may exhibit microgyria, ulegyria, porencephaly and a host of other malformations.

Whereas the quantitative defect in microcephaly is obvious, many idiots have heads of normal size, but it has been our experience at the Fountain Hospital that all idiots and indeed most imbeciles present at post-mortem gross abnormalities of the brain sufficient to account for their mental defect. As an example Fig. 3 shows an extreme form of destruction of white matter. In this case likewise it is improbable that any considerable amount of what may be described as “ higher nervous activity ” could take place.

It must be remembered, however, that “ mental deficiency ” is primarily a social rather than a medical term, especially with high-grade cases. There

* A contribution to a discussion on this subject at the Royal Society of Medicine Psychiatric Section, 10 April, 1951.



FIG. 1.—A microcephalic idiot with spastic diplegia and cataracts; cranium very small, now aged 11 and in good physical health.—By permission of the publishers of Tredgold's 'Mental Deficiency.'

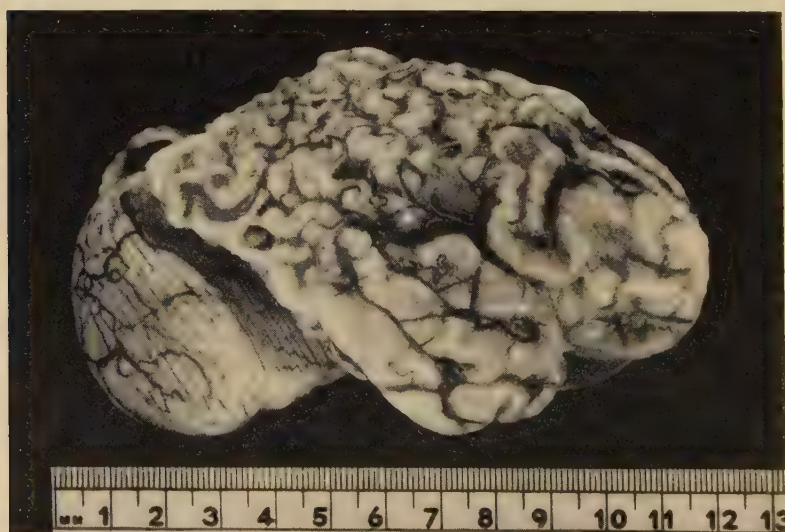


FIG. 2.—Gross microcephaly with obvious qualitative defects in cortex in addition to overall quantitative defect.

is no clinical entity corresponding to this group. Approximately half of the new admissions to a large mental deficiency hospital (Tizard and O'Connor, 1950) were found to have an intelligence within the normal range (though the proportion varied widely with different tests), and there is therefore obviously a considerable overlap with the normal population. On this account it would be surprising if the higher ranges of mental defectives showed any gross difference from the normal in their reactions to bodily diseases. Sweeping statements tend to be made about this matter. There is no doubt that just as the patient's mental outlook influences the course of the disease, so the

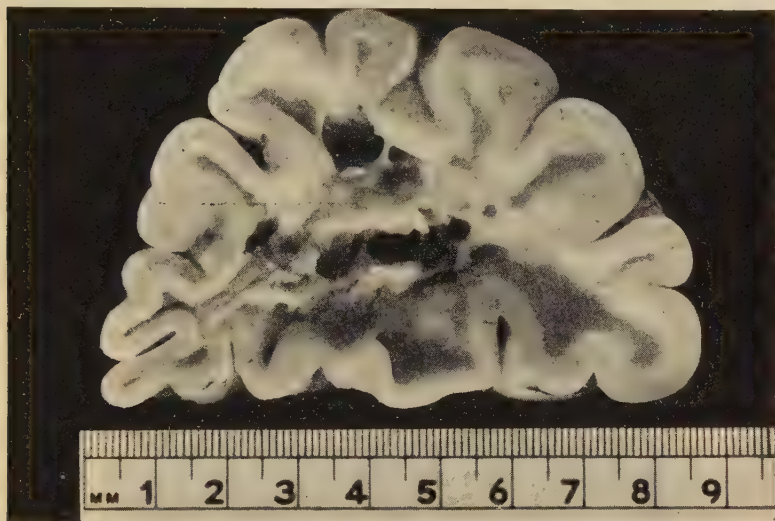


FIG. 3.—Extreme destruction of the white matter of the hemisphere.

physician's outlook influences his estimation of the condition. Fig. 4 illustrates something of the institutional atmosphere which clung to any individual labelled as mentally defective in the past, and which even to-day is inclined to colour the attitude of the physician to defectives.

It is interesting therefore to see that as early as 1881 Dr. Ireland (1898) was emphasizing the importance of hygiene and medical supervision in mental defectives. In fact, he attributed a rise in the death-rate at Larbert Institution to the absence of necessary skilled advice. In other words, in his view the selectively higher mortality of idiots and imbeciles was not an absolute phenomenon but was capable of being modified by outside conditions. When therefore we come across signs and symptoms which are atypical in mental defectives, we must first ask ourselves whether the peculiarity is an aspect of mental deficiency, or whether it is due to the institution régime. Figs. 5A and 5B are X-ray films of the thigh of an idiot taken in 1950 showing an extreme degree of scurvy. It may be suggested that in the idiot the ability to absorb or to retain ascorbic acid may be insufficient. This is possible, though controlled metabolic experiments on doubly incontinent idiots who are difficult



FIG. 4.—Picture to illustrate institutional dress and atmosphere a quarter of a century ago.



FIG. 5A.

to feed are not easy. It is, however, easier to assume that there is some inadequacy in the diet of a patient with such severe scurvy. If this is so it is more than probable that the diet of many other idiots is defective in various food components. It is easy to understand that this may be the case when it is remembered that the tedious spoon-feeding of the idiot is a process which may take a full half-hour. Moreover, I am assured by the nurses whose task this is that the slightest alteration in the soft pappy diet which is commonly given to this type of patient may lead to a complete refusal of food.



FIGS. 5A and 5B.—Gross scurvy in a low-grade imbecile—X-ray films of thigh and knee. Good response was obtained to ascorbic acid by mouth.

It is similarly suggested that pneumonic reactions in idiots are atypical. It may well be that further investigation may reveal that this is indeed a feature of idiocy *per se*. However, in the meantime I think it is important to be certain that we are not dealing with, for example, an unsatisfactory response to sulphonamide therapy producing agranulocytosis. I have seen heavy sulphonamide deposits in the kidney of an idiot at post-mortem, and one knows that with low-grade defect a reasonable level of fluid intake may be very difficult to achieve. Similar considerations apply to other drugs. Fig. 6 shows the excrescences from the gums found post-mortem in a case of idiocy treated with sodium hydantoinate for epilepsy. The lower the level of

intelligence the higher the incidence of epilepsy, and considerable quantities of drugs are administered with the hope of preventing fits to even low-grade institution patients, though the benefits derived from this treatment are often dubious. It seems likely that in a patient saturated with a drug to the extent of producing toxic reactions responses to bodily disease may be appreciably altered. This consideration applies also to sedative drugs such as paraldehyde, chloral, bromide, which tend to be freely used for restless patients, again often with little reduction of the restlessness.

In considering chest infections in young children the importance of the surrounding conditions is particularly obvious. Mental deficiency shares

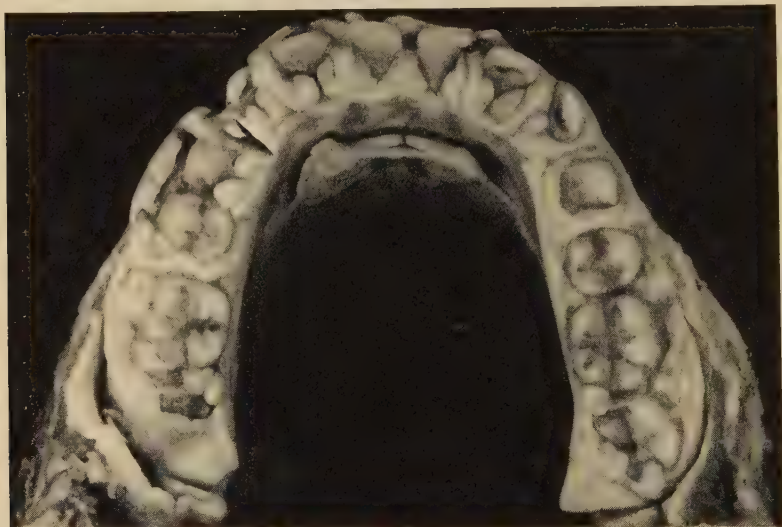


FIG. 6.—Excrescences on gums in patient treated with hydantoinate for epilepsy—first noticed postmortem.

with tuberculosis the unenviable position of being the first claimant for increased hospital accommodation. A reflection of this is the extreme overcrowding observed in wards for mental defectives. The shortage of nursing staff likewise leads to the persistence of very large wards. Thus the young child, direct from home, having possibly had little previous contact with infection (being considered ineducable and not having attended school), is subjected to a concentrated bacterial attack in a ward with perhaps 50 or more other young inmates. The child has the added emotional stress of separation from parents, the sudden need to adjust to the society of a large number of other children, to a new diet and to a wholly new method of life. It is not perhaps surprising that a number of such children should succumb to pneumonia relatively soon after admission and that the pneumonia should present unusual features, which produce the impression that the patient has died at an unusually early stage of the disease. It may well be that in lower grade mental defect this is the case. For example, we expect that a cripple with

Little's disease, with extreme athetosis or with other paralytic lesions, should find it impossible to sit up or to cough effectively. This latter disability is painfully obvious in the case of the baby with mongolism suddenly smitten with a respiratory infection. Moreover, anyone who has followed serial X-ray films of chests in mongolism cannot fail to be impressed by the frequent occurrence of a slowly resolving pneumonic process the full resolution of which may occupy 6 months to a year. So much is this the case that a radiological diagnosis of tuberculosis is suggested, to be ruled out by a negative Mantoux test, the general condition and the ultimate outcome. Here too, however, I do not think there is sufficient evidence to suggest that we are dealing with anything specific to mental defect. It is peculiarly easy with children in an institution to take such X-ray films, and it seems to me likely that a similar procedure with other delicate children, not regarded as mentally defective, would produce similar results, e.g., children with chronic otorrhoea. One knows, moreover, that if the patient survives his first year of institutional life, he may well survive many more though he be the most crippled of idiots, his brain less efficient than the nervous system of the earthworm; this, in spite of a system of passive spoon-feeding, in which some at least of the liquid food must offer repeated insults to the respiratory mucous membrane.

I have summed up elsewhere our experience at the Fountain Hospital in regard to tuberculosis in cases of mongolian imbecility who form 10 per cent. of our population (Kirman, 1950). In this instance, too, it is clear that the freedom from infection which we experience depends on external conditions and that a wider survey is essential. A step in this direction has been made by Wells and Wylie (personal communication) incidental to their survey of the use of the vole tubercle bacillus as an immunizing agent. Their results do not show any difference between cases of mongolism and other defectives (if allowance is made for the different age-groups from which "mongols" may be drawn) in regard to the ease of conversion of negative reactions to positive as a result of inoculation, nor is the incidence of spontaneously positive Mantoux tests in "mongols" very markedly less than in other mental defectives. Thus even the cherished belief that patients with mongolism are peculiarly susceptible to tuberculosis has not as yet been put on any sure scientific basis. Improvement in institution dietetics following the introduction of war-time rationing may be a factor in the improvement which appears to have taken place in this respect.

I do not wish here to discuss the neurology of mental deficiency, since we are presumably endeavouring, so far as that is possible separately, to consider disease of other organs than the nervous system, but I would like to emphasize that there is no single sign or symptom peculiar to idiocy if we bear in mind the process of development of the normal child. The obvious example is that of the extensor plantar response in, say, a child of 4. Physical and mental development tend to go together in mental deficiency and it is the rule for both to be retarded. Thus the idiot of 4 has the mental development of a baby of, say, 9 months. His physical development parallels this. He looks, as indeed he is, still a baby. He still does not talk or walk, and quite naturally therefore his plantar responses are extensor. This does not indicate

any new lesion. It may be the effect of damage at a very early stage of uterine development. It does not mean, however, that he will never walk. He probably will unless there is a specifically motor lesion. When he does the plantar responses will become flexor. This plasticity of the human organism even in gross mental deficiency is well shown in kernicterus, where the early picture of spasticity with epilepsy gives place to athetosis and generally lowered muscle tone without fits as the child grows. In dealing then with signs of bodily disease in a mental defective it is wise to pay attention to the mental age rather than the chronological one. If this is done many physical signs may seem less anomalous. Thus the idiot seen playing unconcernedly with his nearly severed foot after a bomb explosion was nearer in response to a newborn infant than a grown lad.

The bodily diseases and the reactions to disease of mental defectives present a vast field which should be fruitful for medicine in general. So far no systematic attempt has been made to reap this rich scientific harvest. In my opinion this can no longer be done by treating mental defectives as a homogeneous group. The case of kernicterus whose brain, with the exception of the basal ganglia, may be relatively intact may be in a bed adjacent to the microcephalic, with a brain weighing only a few ounces; both are classed as idiots, but there the resemblance ends. Adequate study of these problems will be facilitated as the operative factors in the production of mental deficiency are better understood. Thus an investigation of the development of immunity in idiots in general may reveal little. A similar study of phenylketonuria may be most illuminating. Such surveys, however, can only be undertaken by the joint efforts of a team comprising psychiatrist, psychologist and social worker in conjunction with the pathologist and with those working in the field of general bodily diseases.

SUMMARY.

In view of the importance of the brain in determining bodily reactions it is to be expected that anomalous signs would be encountered in gross mental defect. Illustrations of gross defect of cerebral tissue are given. However, high-grade defectives have much the same level of cerebral function as 5 per cent. of the population. The institutional régime may be more important than the brain lesion in determining the reaction to disease in in-patients. The reaction to tuberculosis in "mongols" is not demonstrably abnormal. In neurology the abnormal developmental pattern demands a different evaluation of signs from that in acute or recently acquired lesions in adults. There is little evidence that signs of bodily disease in mental defectives are truly anomalous, but to provide an adequate answer to this question extensive, systematic, planned research into the physiology of mental defect must be undertaken.

ACKNOWLEDGMENTS.

My thanks are due to Dr. L. T. Hilliard for criticism and suggestions, to Dr. L. Crome for provision of pathological specimens, to Dr. A. G. Wells

and Dr. J. H. Wylie for permission to use the resultants of their survey, and to Mr. J. E. Stevens for the photographs.

REFERENCES.

- BYKOV, K. M., and KURTSIN, I. T., *Klin. Med.*, 1949, (No. 9) **27**, 6-23.
IRELAND, W. W., *Mental Affections of Children*, 1898, p. 268. London.
KIRMAN, B. H., *Am. J. Ment. Deficiency*, 1950, **54**, 4, 484-494.
PAVLOV, I. P., *Lectures on Conditioned Reflexes*, 1928. New York.
TIZARD, J., O'CONNOR, N., and CRAWFORD, J. M., *J. Ment. Sci.*, 1950, **96**, 405, 889-907.
-

THE PATHOGENESIS OF SOMATIC DISEASE IN MENTAL DEFECTIVES.

By L. CROME, M.C., M.R.C.P.Ed.

From the Department of Neuropathology, The Fountain Hospital, London.

THE problems of the interdependence and unity of the brain and body have been put on a scientific basis by Pavlov and his successors. Bykov (1947) has, for example, been able to demonstrate that the cortex plays a leading part in the regulation of somatic processes, such as secretion of urine, blood pressure, peristalsis and metabolism. It is therefore reasonable to argue that lesions of the central nervous system will be reflected in the pathogenesis and course of morbid processes in the body. It does not follow, however, that this influence will necessarily be in the direction of greater lability, more rapid pathogenesis or more extensive destruction. The outstanding feature of the central nervous system is its plasticity and power of compensation. It is therefore possible and probable that those parts of the nervous system which remain intact will take over and compensate for the function of the lost ones. Emotion may, for example, lead to polyuria, but it does not follow that urinary secretion will be impaired in a leucotomized patient. The brain may well play an important part in the infective processes of a normal person, but the defence against infection in a microcephalic idiot may remain perfectly adequate, and may even be more effective than in a normal person, provided that the mechanism of the immunity and phagocytosis had been more fully mobilized in the course of his previous life.

In assessing the part played by the brain in any alteration of pathogenetic processes, it is important to realize that the nervous system acts not merely by virtue of its purely physiological, i.e., mechanical and humoral, connections with other organs. The brain is also the organ of the mind, and it is the mind which enables man to live normally in society. Disease is not only an altered physiological state, but also a social one. Since it is the brain which enables man to live in society, it is obvious that mental derangement following cerebral disease will alter the patient's social position. It may well be that in some cases it is this social change which plays the greatest part in the altered pathogenesis of physical disease.

The morphological appearances of pneumonia in idiots are often different from those seen in mentally normal children. The lungs of such idiots show a more varied pattern, consisting of lobular collapse, emphysema, inhalation pneumonia, along with patches of early purulent infiltration of the terminal and respiratory bronchioles. It may be that the defective brain contributes to the production of this characteristic picture through impairment of the nervous control, but it is more likely to be the result of the patient's

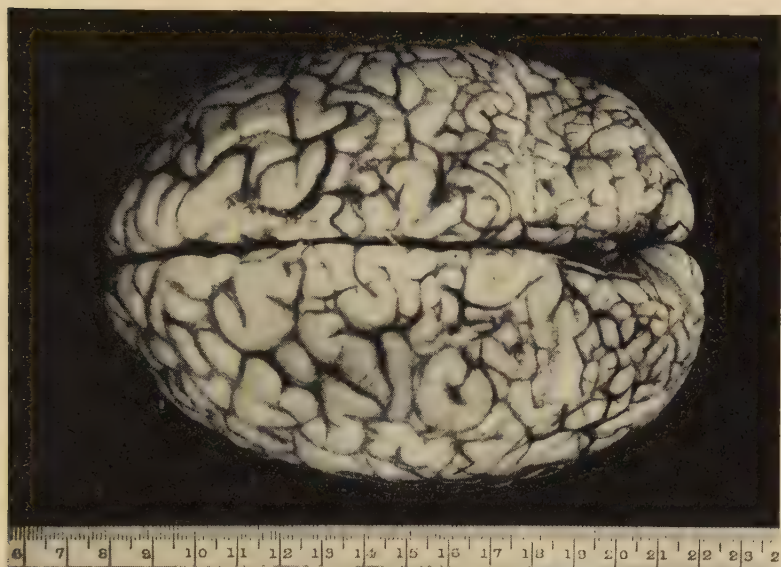


FIG. 1.—Dorsal view of the brain. Ulegyria of posterior part of the cortex.

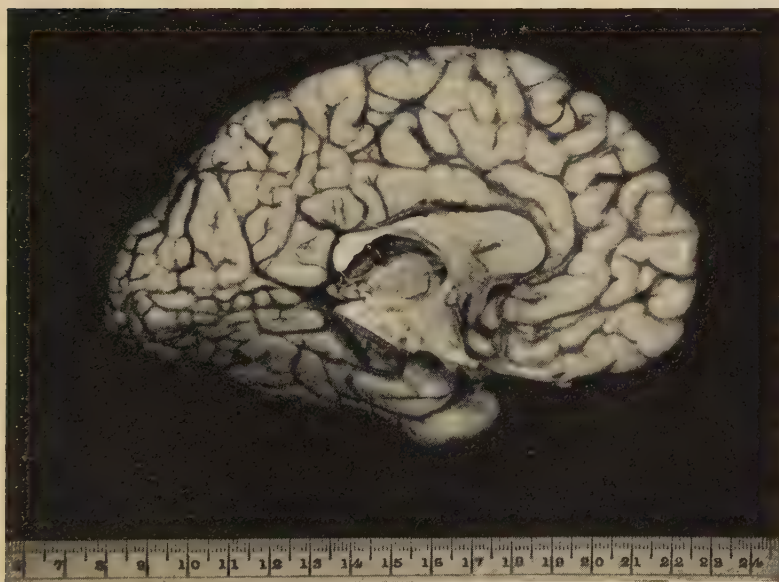


FIG. 2.—Medial surface of the right hemisphere.

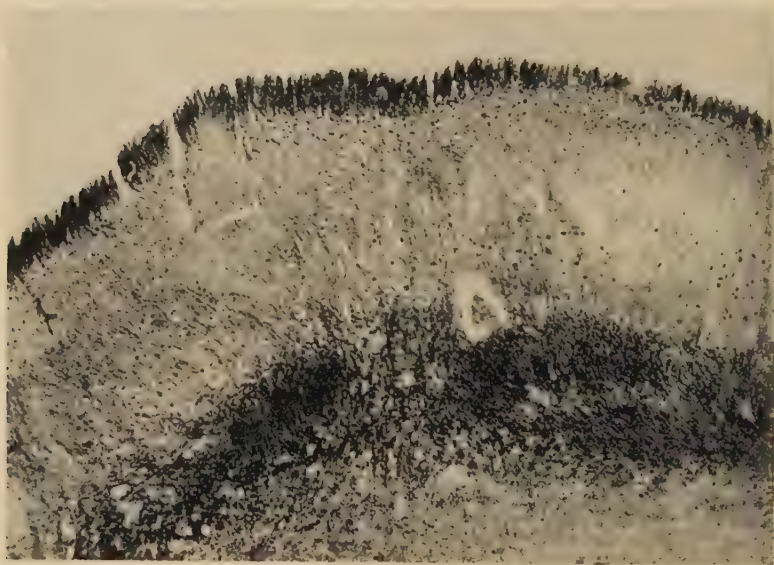


FIG. 3.—Marginal and laminar gliosis of the cortex. Holzer stain. $\times 60$.

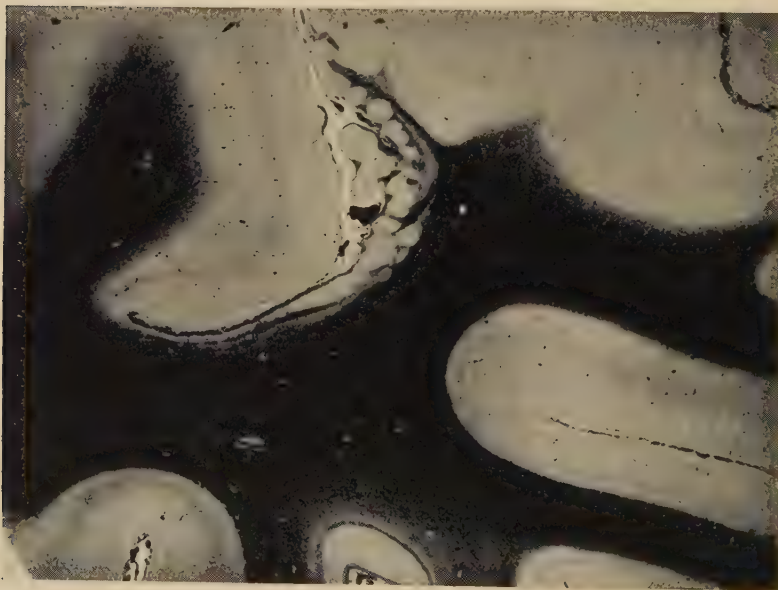


FIG. 4.—Granular atrophy and status marmoratus of cortex. Phosphotungstic acid haematoxylin. $\times 24$.

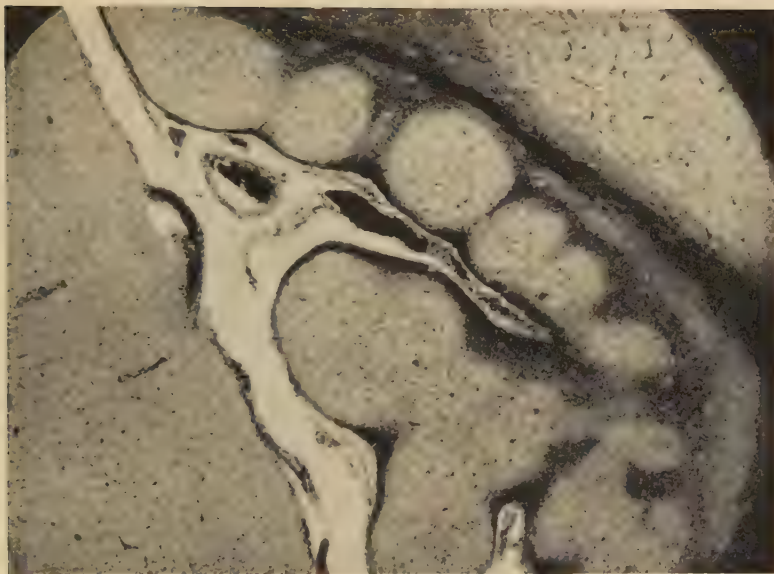


FIG. 5.—Status marmoratus and plaques fibromyeliniques. Phosphotungstic acid haematoxylin. $\times 50$.



FIG. 6.—Periventricular gliosis. Holzer stain. $\times 60$.

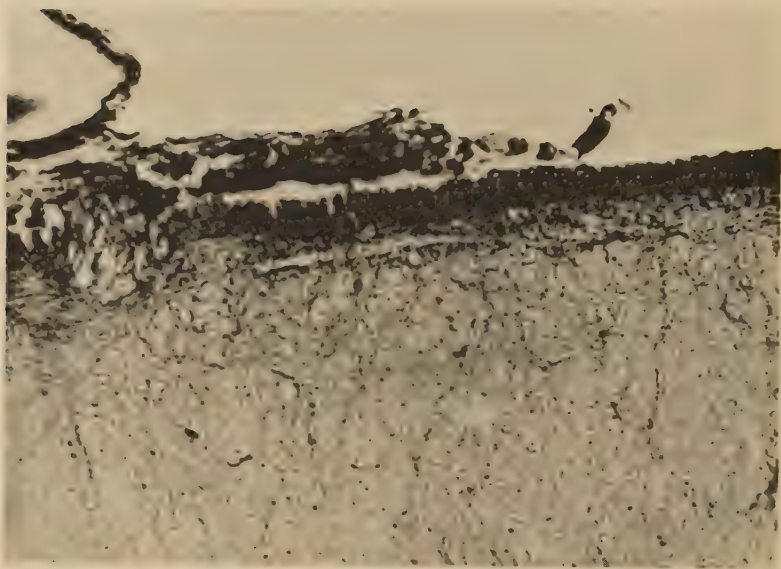


FIG. 7.—Marginal gliosis of brain stem. Holzer stain. $\times 60$.

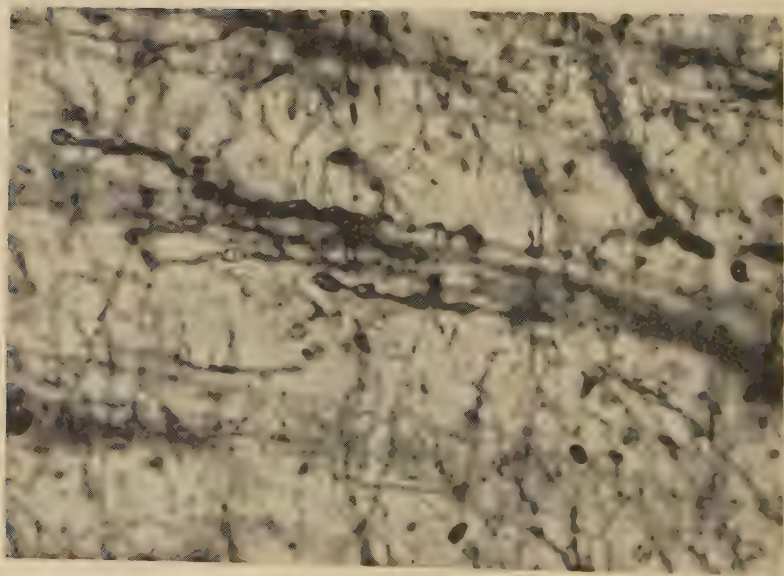


FIG. 8.—Beading and varicose dilatations of myelin sheaths. Heidenhain's haematoxylin. $\times 700$.

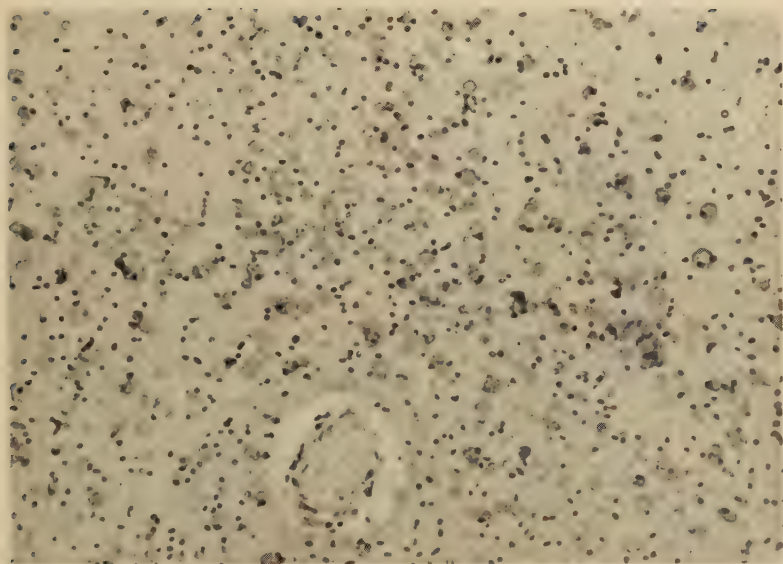


FIG. 9.—Metachromatic bodies in white matter. Mucicarmine and iron haematoxylin. $\times 280$.

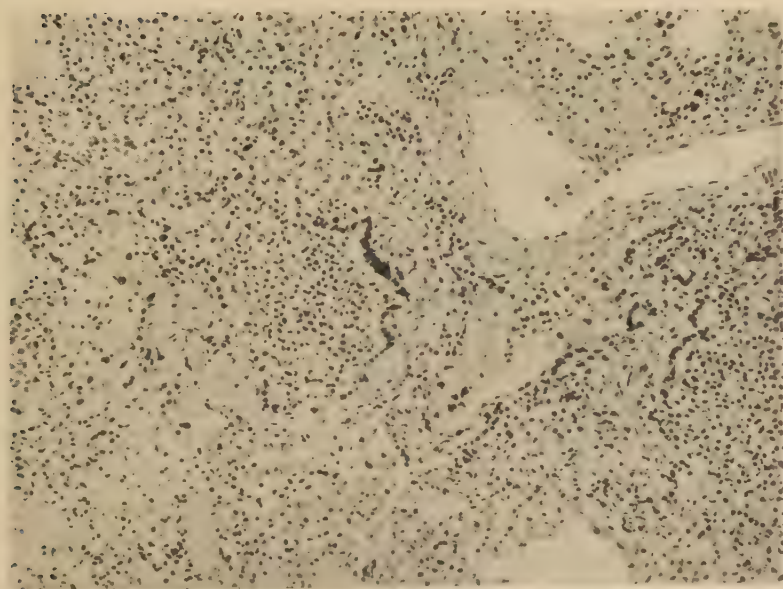


FIG. 10.—Lungs. Early broncho-pneumonia. H. and E. $\times 280$.

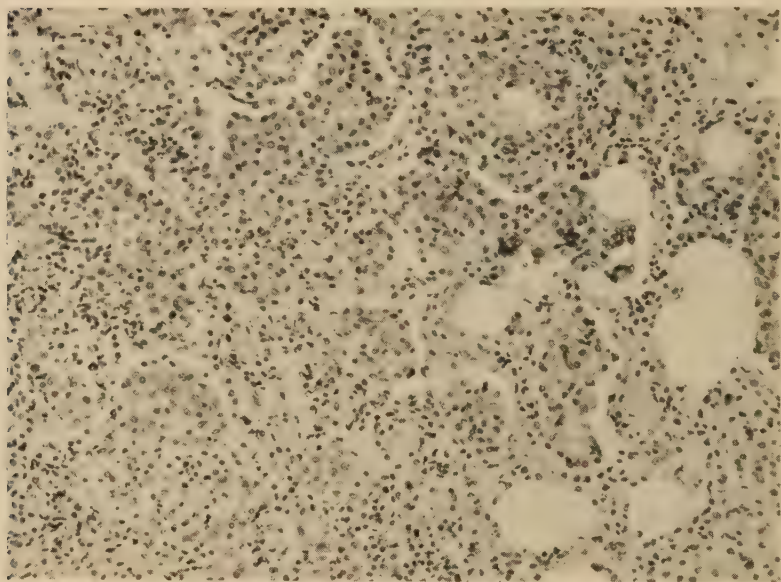


FIG. 11.—Lungs. Inhalation pneumonia. H. and E. $\times 280$.

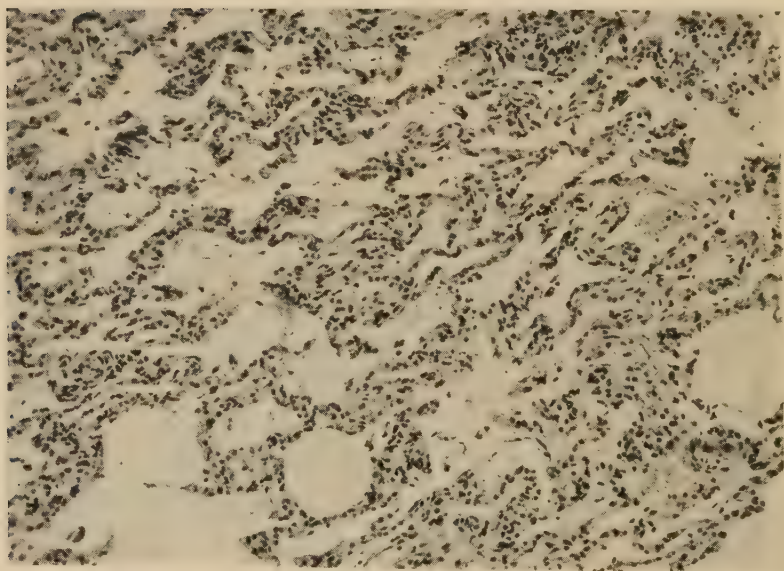


FIG. 12.—Lungs. Partial collapse. H. and E. $\times 280$.

immobilization, difficulty in coughing, inadequate nursing and lack of maternal care. The following case illustrates this position.

CASE REPORT.

The patient was the tenth child in a family in which the preceding four pregnancies of the mother resulted in stillbirths. He was delivered by Caesarian section after a seven months' pregnancy. The patient's abnormality was noticed soon after birth, and he was later admitted to the Fountain Hospital with cerebral diplegia, epilepsy and idiocy. He died from broncho-pneumonia at the age of four.

Examination of the brain, which was normal in size, showed that the gyri in the posterior half of the brain were narrower and more convoluted than in the anterior half (Fig. 1). The corpus callosum was short and its body thin. The transverse fissure was wide (Fig. 2). Microscopical examination showed widespread cortical gliosis of the narrow gyri in the posterior half of the brain. This gliosis was both marginal and, in places, laminar in distribution, involving layer III of the cortex (Fig. 3). In addition, there were patches of granular atrophy and marbling of the cortex with the presence of plaques fibromyeliniques (Figs. 4 and 5). There was also extensive periventricular gliosis (Fig. 6), and marginal gliosis of the brain stem (Fig. 7). The myelin of the white matter did not appear to be affected when examined with the naked eye in appropriately stained sections, but microscopically it showed beading and varicose dilatations of the myelin sheaths (Fig. 8). Diffusely scattered metachromatic bodies were seen throughout the white matter (Fig. 9).

The lungs showed in a few places the characteristic changes of early broncho-pneumonia (Fig. 10). In other areas the alveoli were filled with masses of mono- and multinucleated phagocytes containing debris of inhaled material (Fig. 11). There were also areas of lobular collapse (Fig. 12), emphysema and oedema.

DISCUSSION.

The significance of metachromatic bodies in the white matter of the brain is still uncertain (Smith, 1949). The remaining structural changes are, however, familiar findings in the brains of idiots. They are suggestive of the occurrence of some destructive process during the later stages of intra-uterine life or at birth.

The pulmonary lesions in this case are consistent with bronchiolar infection combined with inhalation pneumonia and lobular collapse following bronchiolar obstruction.

It may be supposed that the gross cerebral damage present in this case had contributed to the establishment of some defect in the autonomic innervation of the lungs and to the impairment of defence mechanisms in it. Such a possibility cannot be excluded, but there is no positive evidence to support it. On the other hand, an acquaintance with institutional life and the knowledge of the patient's physical and mental disability afford a simpler and more plausible explanation of the changes in the lungs. They can be best explained by the patient's difficulty of coughing and clearing the obstructed bronchioles,

along with inhalation of food and a superadded bronchiolar infection, or, in other words, by factors closely related to the specific social environment of the patient.

The modifying influence of an anomalous social position on the pathogenesis of somatic disease may be more apparent in some cases, while physiological processes may be more evident in others. This variation in the degree of their relative impact cannot justify their separation. The two remain interrelated. Thus the immobilization of a patient with quadriplegia or in extreme catatonia may lead, even in the absence of cortical damage, to as much change in social status as microcephaly.

It can be concluded that lesions of the nervous system may modify the course of physical disease in the body either by their effect on physiological processes or through the mediation of social factors. It may be more the one or more the other in different cases, but usually it is a combination of both. Both form an integral part of the natural history of disease. Society is, after all, no less a product of life than phagocytosis or bacterial immunity. Social factors therefore rank equally with physiological ones in the complex of pathogenetic change.

SUMMARY.

Lesions of the nervous system may influence the pathogenesis of somatic disease not only through their effect on physiological processes, but also by the alteration of the patient's social environment. The two sets of processes are not independent of each other. Both form an integral part of the natural history of disease. The effect of a characteristic social environment on the pathogenesis of lesions in the lungs is illustrated by a case report.

REFERENCES.

- БЫКОВ, К. М., *Kora golovnogo mozga vnutrennei organov*, 1947. 2nd ed. Moscow and Leningrad : Medgiz.
SMITH, M. C., *J. Neurol. Neurosurg. Psychiat.*, 1949, **12**, 100.
-

STUDIES IN THE PHYSIOLOGY OF AWARENESS: THE INCIDENCE AND CONTENT OF DREAM PATTERNS AND THEIR RELATIONSHIP TO ANOXIA.*

By J. W. LOVETT DOUST, B.Sc., M.B., B.S.Lond., M.R.C.P.

(From the Laboratory of Psycho-physical Relations, University of London,
Institute of Psychiatry, Maudsley Hospital.)

INTRODUCTION.

The study of dreams is a study of a group of epiphenomena associated with states of diminished awareness. No matter whether such dreaming occurs in natural sleep, in states of reverie interspersing normal levels of consciousness or in pathologically or pharmacologically induced aberrations of consciousness, it would appear that the principle that dreams do not occur other than at levels of lessened awareness is generally accepted. From the point of view of neurophysiology, it also seems reasonably clear that the formation of the visual and auditory hallucinations, illusions and delusions forming the manifest formal content of dreams is dependent upon fairly precise cerebral localization, the temporal lobe and Brodman's area 19 being especially important in these respects (Penfield and Erickson, 1941). Psycho-physiologically a number of attempts have been made to assess the nature and quality of stimuli normally inciting dreams. From Maury (1861) onward the effects of various physical stimuli (Klein, 1930), of auto-suggestion (Arnold-Forster, 1921), of post-hypnotic suggestion (Prince, 1939) and of projection phantasies (Malamud and Linder, 1931) have been noted. Psychologically the dynamics underlying the mechanisms of the dream instinct have been investigated especially by Freud and his followers. Freud's opinion that the dream represents an attempted wish fulfilment has been modified by Jung, who emphasizes its compensatory function, by Adler, who conceived of the dream as a method for testing possible future situations in phantasy, and by Stekel (1943), for whom the dream was a symbolic manifestation of the "internal conflicts" of the individual. Finally, the observations of Monge (1929) concerning the increased incidence of disturbing dreams when dwellers at high altitudes suffer from chronic mountain sickness, and of McFarland (1937) on the changing dream habits of a party of mountaineers in the Chilean Andes as they ascended steadily to ever-increasing altitudes (and hence to progressively greater degrees of anoxic anoxia), are of immediate interest. They are in direct line with the findings of anoxaemia in sleep (Lovett Doust and Schneider, 1951), and suggest a positive relationship between the manifest content of dream patterns, emotional tension, reduced awareness and anoxaemia.

An opportunity to contribute to this varied literature occurred when a group of healthy normal individuals was made available for investigation at

* Work done during the tenure of a Nuffield Foundation Fellowship in Psychiatry.

the Institute of Psychiatry. It appeared to be of value to contrast the dreaming habits of such a normal control group with those of a group of psychiatrically disturbed patients, and to accomplish this in a fashion permitting of statistical analysis of the data and the control of some at least of the many variables involved. The investigation presently reported represents an attempt to study and inter-correlate a number of these variables. It was decided to limit the inquiry for the sake of clarity to a few, yet well-defined, elements of the dream; to bring out, so far as was possible, the epiphenomena of states of relative unawareness; and to concentrate on the differences, if any, appearing when the tendencies shown by the healthy group were compared with those of the psychiatrically disturbed patients.

CLINICAL MATERIAL AND METHODOLOGY.

The responses of 553 individuals were investigated. Of this total 260 were *healthy control subjects*, 208 of whom were army personnel and the remaining 52 nurses, physicians, hospital staff and business folk. All the soldiers were males, while the sex distribution of the remaining controls was males 30, females 22. The overall age range for the control group was 18-45, with a mean age of 25.93 years.

An abnormal group of 293 patients made up the rest of the total. Of these, 14 were out-patients from the West End Hospital for Nervous Diseases and suffered from *migraine*; they were investigated by the courtesy of Dr. Anne Bolton. The remaining patients were all suffering a *psychiatric* disturbance; 128 were soldiers drawn from neighbouring military hospitals, and the rest were in-patients at the Maudsley and Bethlem Royal joint Hospitals. The army group were all male; the civilian group included 100 females. The age range for the entire abnormal group was 15-75 and the mean age 27.63 years.

The distribution of diagnoses among the psychiatric group of patients was as follows:—

- (a) *Character disorder*: 37 cases of psychopathic personality.
- (b) *Psychoneurosis*: 76 patients with hysteria; 72 with anxiety state.
- (c) *Psychosis*: 41 patients with affective disorder—depression; 38 with schizophrenia.
- (d) *Organic affection*: 15 cases of idiopathic epilepsy.

The incidence analysis given in Table I shows some discrepancies by comparison with these figures. This occurred because it proved impossible for all subjects to give answers to all questions asked.

During the course of an interview each subject was asked a number of questions concerning the pattern and type of his dreams, and the answers were recorded in questionnaire fashion for future statistical analysis. The actual questions asked were as follows:

1. Do you sometimes have terrifying dreams or nightmares?
2. Do you day-dream much?
3. Do you like day-dreaming and building castles in the air?

4. When you dream at nights do your dreams seem sometimes very real ?
5. Have you ever had difficulty in deciding what was a dream and what was real life ?
6. Do you dream in colours sometimes ?
7. Have you ever felt that your body did not belong to you ?

A smaller sub-group of 135 subjects were also asked to record the last vivid dream they could recall, and various features of these actual dreams were selected for comparative analysis in order to see whether the dreams of 67 normal healthy subjects differed in any significant fashion from those of 68 psychiatrically disturbed patients. All subjects in this sub-group, both controls and patients, were males and army personnel; particular attention was paid to assessing the influence of their military experience on the content of the recorded dreams. Features classified for this group were as follows:—

(A) *Content suggesting temporal sequences*: Obvious reflection of current life situational stresses; past experiences; simple future possibilities; possible future fear fulfilment; war experience.

(B) *Participants in dream*: Animals only; humans only; animals and humans; self and animals; self recognized as participating.

(C) *Sex of participants*: Male only; female only; male and female. (Note: All dreamers in this group were of male sex.)

(D) *Predominating affect of dream*: Pleasant; unpleasant; anxiety; anxiety awakens dreamer; anger. (Note: When more than one affective state seemed vividly represented, each was included.)

(E) *Phantasies of violence*: Violence mentioned in any form; fire; wounding or maiming; death or dying.

(F) *Phantasies of levitation*: Sensation of being suspended or flying in any fashion; falling or crashing or sensation of going down suddenly.

(G) *Pavor nocturnus*: Any dream ending with orgasm.

The percentage saturation of oxygen in the arterial blood in the awake state was separately determined on a further sub-group of 176 subjects, which included both healthy controls and psychoneurotic patients. The spectroscopic oximeter technique of Ray (1946) as modified by the present writer (Lovett Doust, 1951) was employed for this purpose, the equivalent "reduction time" being expressed in seconds for comparison purposes in the chart (Table IV).

No effort was made to encourage associations by the subjects on the dreams recorded—a feature which would detract markedly from their interpretation on orthodox psychoanalytic lines. Such, however, was not the main purpose of the investigation. Certain schools of psychodynamic psychopathology are not as insistent as the pupils of Freud on free association, holding that interpretation can go far if certain broad principles are observed. One such school is that of W. Stekel, whose fundamental tenets regarding the psychodynamics of dream interpretation are set forth in his book (1943). An attempt to classify further the dynamic content of the recorded dreams of the two selected normal and abnormal army sub-groups has been made in accordance with

what Stekel called the "symbols of parathy." These symbols he has classified (vol. i, p. 19) into 6 groups, divided as follows: (1) All authority figures; (2) the brother, sister, friend, enemy, uncle, aunt, the "other," etc.; (3) servants; (4) wild beasts, devil, criminal, outcast, etc.; (5) the cage, cross, little woman, old house, new house, church tower, palace, embankment, chain, rope, shadow, wound, abscess, tumour, privy, shirt, dress, skin, helmet, tight shoe, spectacles, crutch, staff, umbrella, mask; (6) the blind man, deaf man, dumb man, lame man, lunatic, idiot. The results of the classification and its analysis are given in Table III.

The appendix completing this paper gives sample dreams from the 135 recorded during the investigation, and illustrates the type of content occurring in a number of different psychiatric conditions.

RESULTS.

These are given in Tables I-IV. The statistical method employed for analysis was that of the 2×2 and $2 \times k$ chi-squared, Yates' correction for continuity being applied to the computations. Where the expected number was too small for the chi-squared method no test of significance has been given, though the incidence figures are included in the tables to indicate the tendencies found. Student's t test was employed to test the significance of differences in the cross-correlation of arterial oxygen saturation values and certain of the dreaming characteristics.

Dream Pattern—Questionnaire Technique (Table I).

Nightmares and frightening dreams were significantly more frequent in all psychiatrically disturbed groups than in the healthy controls, as was the ability to recognize colour in the dream experience. More patients confessed to an occasional inability to distinguish dreams from reality than did the controls. There was no significant difference in the incidence of obviously wish-fulfilment dreams, nor in those subjects who admitted enjoying reverie experiences.

Formal Content Analysis (Table II).

The results indicate that fear and anxiety situations figure significantly more commonly in the neurotic patient's dreams than in those of the controls, while the latter's phantasies more often included human beings than did those of the neurotics. War experiences appear to be of little importance in distinguishing the two groups. Dreams of violence, and especially of wounding maiming and dying, are more characteristic of neurosis than of normality. Both groups showed a higher incidence of unpleasant than pleasant dreams.

Stekelian Symbols of Parathy—Manifest Psychodynamic Content (Table III).

Two of Stekel's 6 groups of common "symbols of parathy" yielded significant difference between the healthy subjects and the neurotic patients. These were No. 2, dealing with relatives, friends, a person unknown, etc., and No. 5, houses old and new, wounds, etc.

TABLE I.—*Analysis of Dream Patterns by Questionnaire Technique.*

Group.	No.	Enjoy day-dreaming.	Can't distinguish dreams from reality.	Nightmares.	No. recording dreams.	Can't remember.	Dream in colour some-times.	Body unreal.	No.	Wish fulfilments.	Frightening dreams.
Controls	. 260	12	68	37	. 208	31	31	7	. 52	29	20
Psychopaths	. 37	21	18	16	. 26	3	6	5	. 13	3	3
Hysteria	. 76	39	37	35	. 51	2	13	18	. 25	6	13
Anxiety state	. 72	43	35	37	. 47	4	21	5	. 25	4	15
Depression	. 41	23	12	21	. 8	0*	—	12	. 41	2*	2*
Schizophrenia	. 38	23	15	20	. 2	1*	2*	15	. 36	1*	0*
Epilepsy	. 15	11*	6*	7*	. 1*	0*	—	5*	. 14	0*	1*
Migraine	. 14	11*	6*	9*	. —	—	—	1*	. 14	—	—
Mental defect	. —	—	—	—	. 7	0*	—	—	. —	2*	3*
Chi-square	. .	10.776	25.577	73.966	. .	8.109	24.129	25.459	. .	6.42	10.262
d.f.	. .	5	5	5	. .	3	3	5	. .	3	3
P level of significance	. .	n.s.	.001	.001	. .	.05	.001	.001	. .	n.s.	.02

Chi-squares computed from the formula for a $2 \times k$ table. The groups denoted by an asterisk are not included in the statistical analysis.

TABLE II.—*Detailed Formal Content Analysis of Recorded Dreams.*

Participants.					Sex aspects of dream and participants.				Temporal relationships.						
Group.	No.	Animals		A. and H.	Self.	Self and animals.	Male.	Female.	M. and F.	Noct. emisn.	Current stress.	Past experi-ences.	Single future wish.	Future fear fulfil-ment.	Past war experi-ences.
		only.	only.												
Controls	67	1	55	7	65	4	35	2	24	1	22	8	31	25	13
Abnormals	68	5	41	7	62	5	33	1	28	6	20	2	22	42	5
Chi-square		*	6.779	*	1.149	*	0.670	*	0.214	*	0.059	2.78	2.188	7.123	3.262
Level of significance		—	.01	—	n.s.	—	n.s.	—	n.s.	—	n.s.	n.s.	n.s.	.01	n.s.
Levitiation experience.															
Group.	No.	Predominating affect.					Traumatic experience.					Levitiation experience.			
		Pleasant affect.	Unpleasant affect.	Anxiety.	Anxiety. awakened dreamer.	Anxiety	Violence.	Fire.	Death.	Wounding; maiming; dying.	Simple floating.	Falling; crashing; going down.	Simple floating.	Falling; crashing; going down.	
Controls	67	32	40	29	14	3	29	3	9	18	2	13	2	13	
Abnormals	68	30	49	40	24	7	44	1	14	35	0	14	0	14	
Chi-square		.064	1.778	2.669	2.784	6.923	5.404	*	6.768	7.567	4.369	*	4.369	*	
Level of significance		n.s.	n.s.	n.s.	n.s.	n.s.	.02	..	n.s.	.01	.05	..	.05	..	

Chi-squares calculated for a 2×2 table; d.f. = 1; Yates' correction applied. Groups marked with an asterisk not analysed because of low E.

TABLE III.—*The Six Groups of Symbols said by Stekel to be Found in "Parapathy." Incidence of Occurrence Classified from Recorded Dreams.*

Group.	No.	Symbols.						Total.
		1 Authority, figures, etc.	2 Rela- tives, etc.	3 Servants.	4 Wild beasts, etc.	5 Cages ; crosses, etc.	6 Halt ; lame ; blind, etc.	
Controls . . .	67	11	17	0	8	13	0	49
Abnormals . .	68	20	36	0	9	33	4	102
Chi-square . .	..	2.528	9.631	—	0.419	11.481	—	..
Level of significance .		n.s.	.01	—	n.s.	.001	—	..

Blood Oxygen Saturation Levels (Table IV).

Despite suggestive differences between the mean values of groups admitting to nightmares and to no nightmares, those who stated they enjoyed letting

TABLE IV.—*Cross Correlation between Dream Analysis and Arterial Oxygen Saturation Expressed as "Reduction Time" Seconds. Significance of Mean Differences Determined by t Tests.*

Dichotomy	Dream pattern.							
	Nightmares.		Recording of dreams.		Enjoy day-dreaming.		Dream in colour.	
	Have	Have not	Recorded.	Can't remember	Enjoy.	Don't enjoy	Colour	No colour
Number	39	137	73	27	80	95	31	134
Mean R.T. (secs.)	38.2	40.1	40.25	38.37	38.52	41.2	40.9	40.3
Equiv. O ₂ satn	96.0%	96.6%	96.6%	96.0%	96.2%	97.0%	96.9%	96.7%
t . . .		0.39		0.92		0.47		—
d.f. . .		174		98		173		—
Level of significance .		n.s.		n.s.		n.s.		n.s.

themselves fall into reverie states (day-dreaming) and those who responded to the invitation to record their dreams as opposed to those who did not, these differences were not significant when Student's *t* tests were applied.

DISCUSSION.

Considerations of growth and development are keys unlocking many of the hitherto closed doors of aetiological problems in psychiatry. The application of ontogenetic principles to the analysis of the dream life of mentally disturbed patients shows these individuals often to be examples of developmental arrest or deviation, especially in the sphere of emotional maturation (Saul, 1947). The findings of the present investigation accord well with these concepts, the concordance being exemplified by the conclusions of similar studies made on children's dreams. Jersild, Markey and Jersild's (1933) study of the dreams of children up to 12 years old showed that at every age unpleasant dreams were more common than pleasant ones. Foster and Anderson (1936), in an analysis of children's dreams, found that the subject-

matter of unpleasant dreams tends to change as age advances, animals predominating in the 1-4 age-group, strange people and abstract forms of unpleasantness in the 5-8-year-olds, while from 9-12 years of age the self participated in unpleasant dream experiences. This latter study also revealed that the better the health of a child the fewer dreams he tends to have, and that dreaming tends to follow states of emotional tension of the preceding day.

The sleep rhythm of children differs markedly from that of adults. This is particularly evident in the temporal relationships between fully awakened states and states of full sleep, children up to puberty spending significantly less time in states of relative unawareness, such drowsy states being "extremely short, if they exist at all" (Hurlock, 1950, p. 508). As Hurlock points out, this physiological fact is probably of greater importance than Freud's belief that children dream less than adults because they have fewer unfulfilled wishes than adults.

The sample dreams given in the Appendix illustrate some interesting differences between the various groups of subjects. Many of these differences are qualitative and classification is difficult; others conform to associations formed by impression among clinicians and psychotherapists. Stekel, for example (*op. cit.*, p. 42), states that every dream analyses itself, and that in the dream the dreamer recognizes his emotional conflict and its cause. For the sensitive psychotherapist the *impasse* of the epileptic patient (dream No. 22) is quite characteristic, as is the circular type of mental clouding experienced by the manic-depressive (dream No. 15) and the phantasy powers of the *alter ego* of the schizophrenic patient (dream No. 21).

In general dreams are the mirrors of anxiety; if such anxiety seeks for expression in a psychopathic personality with difficulties in the socio-cultural-ethical spheres of reaction, his dreams tend to be coloured by such difficulties of adjustment (dreams Nos. 16-20). Similarly if the anxiety appears in an emotionally immature, neurotic subject, the affect, the symbols, the inadequacy, repression and immaturity will not only be reflected in the patient's dreams, but also will be so in a unique and individual fashion in accordance with his specific personality experience (dreams Nos. 5-14 as compared with dreams Nos. 1-4).

SUMMARY.

1. The dreaming habits of 260 healthy control subjects and 293 patients with such psychiatric disorders as psychopathic personality, psychoneurosis, schizophrenia, depression, epilepsy and migraine were investigated.

2. A questionnaire assessment revealed statistically significant differences between these groups with respect to incidence of nightmares and frightening dreams, recognition of colour in dreams, hypnagogic sensations of depersonalization, and occasional inability to distinguish dream life from reality situations.

3. Formal content analysis of actual recorded dream material in 67 controls and 68 patients showed no significant differences between the groups *vis-à-vis* simple wish fulfilment, though when these wishes were broken down into future fear fulfilment and other simple "future" dreams, the abnormal group scored

definitely higher incidences for the former. The dreamer appeared in his own dreams an equal number of times in the two groups, but there was a significantly higher incidence of human representation in the dreams of the healthy controls than in the neurotics. Phantasies of violence, wounding, maiming and dying also played a greater role in the dream life of the disturbed group than in that of the controls.

4. Classification of the symbols used in manifest content of the recorded dreams in accordance with W. Stekel's six groups of "symbols of parapathy" showed significant differences between controls and psychiatric abnormals for two of these groups.

5. Cross correlation between certain features of the dreams of 176 individuals and their awake resting arterial blood oxygen saturation, as determined by a method of spectroscopic oximetry, showed tendencies in the expected direction but no statistically significant differences.

ACKNOWLEDGMENTS.

It is a pleasure to acknowledge my indebtedness to Professor Aubrey Lewis, M.D., F.R.C.P., for facilities at the Institute of Psychiatry enabling this work to be carried out; also to the War Office, Colonel Bootle-Wilbraham, D.S.O., M.C., Lt.-Col. Posner, M.C., R.A.M.C., and the Personnel Selection Officers of the Royal Artillery Depot, Woolwich; Dr. H. J. Eysenck, Ph.D., Reader in Psychology at the Institute, and Dr. Anne Bolton, M.R.C.P., for arranging for the use of clinical material; and to Dr. A. Lubin, Ph.D., and Miss Joan May, B.A., statistical psychologists at the Institute, for advice regarding treatment of the data.

APPENDIX.

EXAMPLES OF ACTUAL RECORDED DREAMS.

1. *T. H—, aet. 22. Healthy control.*

"The last dream I had was about the girl whom I was courting, but eventually finished with. Actual moments of happiness went through my mind, of times we had had together, good times and bad times, in my own home and in hers; films we had seen, dances we had been to and the generally happy times together."

2. *M. B—, aet. 23. Healthy control.*

"Sat on the back seat of the bus with the girl next door."

3. *J. S—, aet. 22. Healthy control.*

"Playing with and captaining the Glasgow Rangers F. C. and winning the Scottish F. A. Cup and League."

4. *N. S—, aet. 38. Healthy control.*

"I dreamt I went home and my wife wasn't feeling quite well."

5. *F. B—, aet. 18. Hysteria and emotional instability. I.Q.—SG4.*

"I have a dream nearly every night about my father and grandmother. My father is blind and I keep dreaming about him."

6. *F. S—, aet. 29. Amnesic hysteria and emotional instability.*

"While waiting in the Camp under 'protective custody' to come here, I dreamt that some person unknown had sat on my baby and squashed her ribs in and she

was taken to hospital. That was all that was involved but it was most vivid. I had not seen my family for several days at the time and I had been thinking of them a lot also when I returned on that particular night."

7. T. R—, aet. 17. *Sensory hysteria and hypochondriasis.*

"I dreamt my mother was dying. I could see her lying on a bed and I woke up sweating."

8. L. M—, aet. 18. *Hysteria : lifelong nocturnal enuresis.*

"When I go to sleep sometimes I get a colour dream. It's just that every colour runs into each other and keeps going round and round for a few minutes and then it goes away."

9. J. M—, aet. 19. *Anxiety hysteria with overdependence and obsessionality.*

"I was flying in the air with no apparent reason and with nothing to support me. It was over a large crowd, and then I met a woman with whom I had intercourse."

10. R. B—, aet. 30. *Chronic anxiety state.*

"My last dream was of me having to return to the Army and leaving my wife and child. I lost my temper as I returned to the Army and went for a long walk and I felt myself falling down a big cliff, then I awoke."

11. L. J—, aet. 21. *Chronic anxiety state.*

"I dreamt that I was attacked by strange animals and was about to be killed."

12. A. E—, aet. 18. *Acute anxiety state with depression.*

"I dreamt that I was fighting a man who had a knife in his hand and was trying to stab me with it. He almost succeeded when I suddenly woke up."

13. A. F—, aet. 39. *Chronic anxiety state and depression.*

"I dreamt I was involved in a motor cycle crash on the speedway and broke my leg."

14. J. O—, aet. 30. *Chronic anxiety state with depression : tuberculophobia.*

"One night I dreamt I saw my mother, who has been dead since 1946. Also my sister, who has been dead since 1933. Also my youngest brother, aged 17, who is alive at present, but in the dream he was a cripple with both legs amputated, sitting on mother's knee."

15. T. S—, aet. 19. *Depression in a cyclothymic personality.*

"Everything I saw was only half completed ; some had arms and no legs, some had no heads. Everything seemed distorted and confused."

16. E. M—, aet. 19. *Psychopathic personality with emotional abnormality.*

"Bombers dropping bombs on a town is all I can remember."

17. J. H—, aet. 37. *Psychopathic personality with anti-social trends.*

"I had won a lot of money by horse racing and was able to buy my own house and settle down with the woman I live with at present. I dreamt also that we went choosing furniture and setting up a home for two, but it was only a dream."

18. D. A—, aet. 25. *Psychopathic personality : homosexuality.*

"I dreamt that one of our corporals was in a bar with me in the West End drinking, and he was the same way as I am."

19. *A. D—, aet. 19. Psychopathic personality : sociopath.*

"Living in the jungle and intending to shoot big game. Finding all the animals unusually friendly and speaking to me quite understandably. I finished up by shooting back at the hunting party and giving advice to the animals, but I didn't reach the end of this dream, or any other."

20. *H. T—, aet. 22. Psychopathic personality : homosexuality and depression.*

"I dreamt that I was being pursued by a crowd of people, and no matter how hard I ran they still gained upon me. I was dressed only in a vest, which embarrassed me intensely as I could only pull it down as far as my navel. Just as the crowd were clutching at me, I awoke."

21. *N. B—, aet. 18. Early schizophrenia.*

"I dreamt I achieved my ambitions. Corrected the errors of others. Pounded startling theories and disproved great theories of the past. Achieved distinction in many branches of knowledge. That no one has ever disproved me in argument because there were many as against myself."

22. *J. K—, aet. 19. Idiopathic epilepsy.*

"A dream of being locked in a shed from which I was unable to escape."

REFERENCES.

- ARNOLD-FORSTER, M., *Studies in Dreams*, 1921. New York.
 FOSTER, J. C., and ANDERSON, J. E., *Child Development*, 1936, **7**, 77.
 HURLOCK, E. B., *ibid.*, 1950, 2nd ed. New York and London.
 JERSILD, A. T., MARKEY, F. V., and JERSILD, C. L., *Child Developm. Monographs*, No. 12, 1933.
 KLEIN, D. B., *Univ. Texas Bull.*, 1930, No. 3009.
 LOVETT DOUST, J. W., *Proc. Roy. Soc. Med.*, 1951, **44**, 347.
Idem and SCHNEIDER, R. A. (1951), in press.
 MCFARLAND, R. A., *J. Comp. Psychol.*, 1937, **24**, 147.
 MALAMUD, W., and LINDER, F. E., *Arch. Neurol. Psychiat.*, 1931, **25**, 1081.
 MAURY, A., *Le sommeil et les rêves, études psychologiques*, 1861. Paris.
 MONGE, C., *Les erythémies de l'altitude*, 1929. Paris.
 PENFIELD, W., and ERICKSON, T. C., *Epilepsy and Cerebral Localisation*, 1941. Springfield, Illinois.
 PRINCE, M., in *Clinical and Experimental Studies in Personality*, Ed. A. A. Roback, 1939. Cambridge, Mass.
 RAY, G. B., *Amer. J. Physiol.*, 1946, **147**, 622.
 SAUL, L. J., *Emotional Maturity*, 1947. Philadelphia and London.
 STEKEL, W., *The Interpretation of Dreams*, 1943. Trans. E. and C. Paul, 2 vols. New York.

CLINICAL ELECTROCARDIOGRAPHY WITH AN ELECTRO-ENCEPHALOGRAPH.

By WALTER FABISCH, M.D.Berlin, M.R.C.P., D.T.M.&H., D.P.M.,

Senior Registrar,

and

E. G. WILLIAMS,

Senior Technician, Dept. of Encephalography, Mapperley
Hospital, Nottingham.

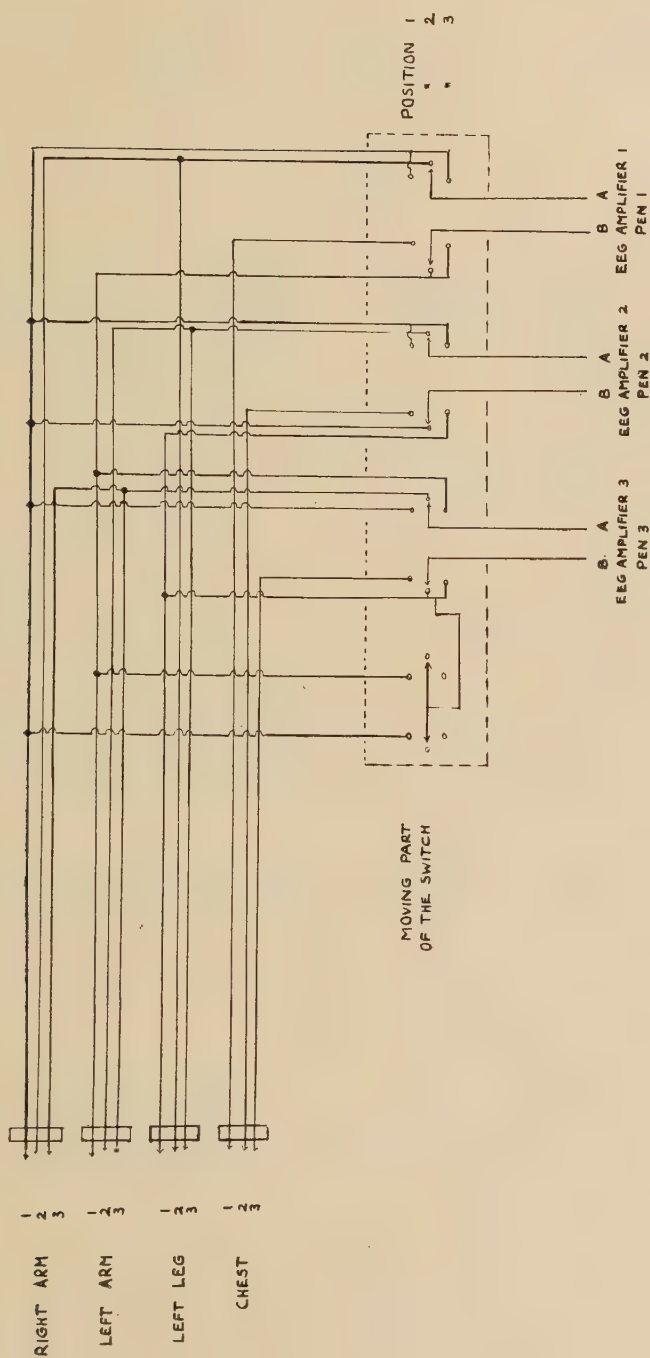
A multiple channel electroencephalograph permits the simultaneous recording of several leads in electrocardiography. In order to utilize for this purpose the electroencephalograph installed in this hospital, a method has been worked out to record in groups of three the 3 standard leads, the 3 augmented unipolar limb leads, and 3 unipolar precordial leads consecutively, changing over from one group to the other simply by turning a switch. The technique here described is used in connection with a four-channel Marconi electroencephalograph.

Three electrodes are placed on each of the 3 conventional limbs, i.e., the right arm, the left arm, the left leg, and on the chest. For convenience of spacing, the limb electrodes are applied to the upper arms and to the calf of the leg. On a normal chest of an adult, 3 precordial electrodes can be placed at the same time in positions 1, 2 and 3, or 4, 5 and 6 without difficulties in spacing and without interference. Three electrodes on each limb are necessary because in recording the augmented unipolar limb leads, each limb enters the circuits singly as well as in two different combinations paired with one and the other of the remaining two limbs. For each of these 3 circuits a separate electrode is required.

The electrodes are connected with a Yaxley wafer type switch with 4 banks, 24 contacts and 3 positions. The switching for standard and augmented unipolar limb leads is done by 18 contacts on 3 banks. Of the last bank of 6 contacts, 2 are utilized in the third position of the switch for unipolar precordial leads to combine one electrode on each limb to form the indifferent electrode. On the diagram, the bottom position (1) of the switch is that used for the standard leads, middle position (2) for the augmented unipolar limb leads, and top position (3) for unipolar precordial leads.

The 6 wires leaving the switch are connected with Nos. 1-6 on the head set, and the pens of the recording unit are connected with these 6 contacts in the following way :

Pen 1	{	A to No. 1 on the selector.			
		B	2	„	„
Pen 2	{	A	3	„	„
		B	4	„	„
Pen 3	{	A	5	„	„
		B	6	„	„



The pens are used to write as shown below :

		Switch position (1) : standard leads.	Switch position (2) : augmented unipolar limb leads.	Switch position (3) : unipolar precordial leads.
Pen 1		I	. aV _L	. V ₁ V ₄
Pen 2		II	. aV _R	. V ₂ V ₅
Pen 3		III	. aV _F	. V ₃ V ₆

It is obvious that any desired combination of 3 locations for the chest electrodes can be used. If more than 3 chest leads are to be recorded, the electrodes are moved on the chest and, after changing their locations, the recording is continued without altering the position of the switch. Since we use as a routine leads V₁ to V₆, two sets of chest leads are written, i.e., first V₁, V₂ and V₃, and after shifting the electrodes to new positions, V₄, V₅ and V₆.

The fourth pen can be used to duplicate any of the other tracings with the same or with a different amplification. Pens 1, 2 and 3 are always calibrated in the usual way so that 1 millivolt gives a deflection of 10 mm. The time constant is set at 0.3 seconds, and the input selector placed in the "independent" position.

The following points should be observed in order to obtain smooth working of the arrangement :

The 3 electrodes on the limbs and on the chest should be at least about 2 cm. apart from each other and no contact through electrode paste should occur between them. The resistance across dry skin is so high that the 3 electrodes on each limb and on the chest act independently if these precautions are observed.

Connections between different parts should be soldered where possible.

Wires connecting the electrodes with the switch and the switch with the head set should run without crossing unnecessarily and should not be twisted together.

The method described has been in use for clinical electrocardiographic work in this hospital for about one year, and, with standard Cossor limb and chest electrodes, has given satisfactory service.

We wish to thank Dr. D. Macmillan, Physician Superintendent, for permission to use the electroencephalograph and to publish this paper.

Part II.—Reviews.

Character Analysis. By WILHELM REICH, M.D. London: Vision Press and Peter Nevill, 1950. Pp. 516. Price 35s.

In this book Dr. Reich describes his therapeutic technique. Genital sexuality has to be freed from the repression of religious morality. It is therefore necessary to disrupt and destroy the repressive influence of the patient's character by "character analysis." "Genitality" is thus "crystallized out" from the jealousy, fear and anger which has invested it secondarily to its repression by a society which is afraid of sex. The "orgasm reflex" and "orgastic potency" are established. Oral, anal and genital sexuality are "instinctual," but "the morals of the ego are a foreign body."

Dr. Reich says that this treatment by character analysis is unpleasant for the patient, but the achievement of genital sexuality through a sensual transference, masturbation and sexual intercourse is worth it. Towards the end of this treatment it is preferable that the patient should marry, but if this is impossible, or if the patient's spouse should not give satisfaction, then sexual intercourse should be sought elsewhere according to the pleasure-unpleasure-principle; for the patient, having become a "genital character," has powers of rational thought, judgment, energy and love which make the prevalent religious and social morality unnecessary.

The orgasm is considered next as a "basic vegetative function." Technical neologisms abound. "Vegetotherapy" consists of non-genital manipulation in order to release the "giving" and "cosmic longing" of the orgasm. This treatment, also, should be completed by the patient finding a lover. Dr. Reich says "perhaps science will one day succeed in making humanity's dream of happiness a reality."

The book concludes with an account of the treatment of a single woman, aged 32, who was suffering from schizophrenia. Dr. Reich describes in a quite brilliant way the vacillation of his patient between accepting sensuality as such and as the "forces" of her delusions.

There is no doubt of Dr. Reich's sincerity and zeal. He is most sensitively aware of the "tragic experience" and wasted energy caused by the repression of sexuality in "small children," adolescence and maturity, and he believes it is quite unnecessary. He is therefore very disturbed by the complacency of the world, including psychiatrists. He does not believe the world need fear sex, if his teaching is accepted. No consideration is given to the present sexual morality being the result of the community's bitter experience that, in certain circumstances, to-day's pleasure becomes to-morrow's greater pain. He does not reflect on the jealousy, fear and anger displayed by mating animals, but attributes these reactions in human beings to the results of repression. He resents the religious morality which condemns fornication and adultery, but he does not give credit to the same religious morality which blesses a greater degree of sexuality in marriage than is achieved by mating animals.

Dr. Reich does a splendid service to humanity by insisting on the problem of the unfulfilled desires of *Homo sapiens* for sexuality and love, but by taking a narrow, one-sided view of the problem, and by arousing, unconsciously, what many will consider to be false hopes, his book invites more indignation and antipathy than the sympathy he so ardently desires and the subject deserves.

C. E. H. TURNER.

Klinische Psychopathologie. By KURT SCHNEIDER. Thieme Verlag, Stuttgart, 1950.

Kurt Schneider is an outstanding representative of the phenomenological school of German psychiatry, strongly influenced by Jaspers in his fundamental approach to the problems of psychopathology. In this small textbook he gives an excellent presentation of general psychiatry from a clinical point of view. He makes a clear distinction between abnormal mental variants (abnormal intellectual "Anlagen," abnormal personalities and abnormal reactions to external conditions) and psychotic illness of somatic origin and with a distinct psychopathological symptomatology. The grouping of the psychotic pictures follows classical lines, the emphasis in describing symptoms being on psychology.

The author's main preoccupation is precision of psychological thinking, alas! so frequently missed in psychiatric writings. This may account for some of his omissions. For instance, in his sharp distinction between reactive and cyclic depression, depressions of the involutional and higher age-group are not discussed. Some readers may also find his conception of schizophrenia—no schizophrenic reaction without schizophrenic illness—too rigid. On the other hand, readers who suffer under the woolly and muddled concepts so widely used in our debates will find satisfaction in the clear, orderly and systematic thinking of the author. One willingly puts up with a certain amount of schematism and too much finality as a slight disadvantage of a book that should otherwise be of great value to many English-speaking psychiatrists if it were translated.

R. KLEIN

Technique of Psychoanalytic Therapy. By SANDOR LORAND, M.D. London: George Allen and Unwin, 1950. Pp. 251. 12s. 6d.

This is a readable book in which the author achieves with consummate ease just what the title indicates.

The technique of psychoanalytic therapy is described, with illustrative cases. The student analyst is warned of various difficulties which the technique imposes upon patient and analyst: the technical answers to these difficulties are given. Professor Lorand also stresses the importance of several old-fashioned virtues, for he says the analyst should be tolerant, kind, benevolent, patient and sympathetic; he should also be willing to admit mistakes and be versatile; he should inspire confidence and trust, and not be discouraged.

The student analyst is told to think of the adult patient "as a helpless weak inhibited child" and "as a fearful, badly behaved child."

Professor Lorand, who is an experienced exponent and teacher of this technique ends his book with a balanced estimate of the therapeutic possibilities of psychoanalysis.

C. E. H. TURNER.

Endocrine Diagnosis. By H. UCKO. London and New York: Staples Press, 1951. Pp. 513. Figs. 84. 42s.

The book is intended primarily for the clinician but should be of use to the psychiatrist, for it pays considerable attention to the minor disorders that lie near the extremes of normal function. The first part of the book deals chronologically with the endocrinological development of the individual, followed by a part on the methods of examination. Then comes a systematic description of the disorders of the individual glands, in which each section is prefaced by an outline of the relevant physiology. Special emphasis is laid on clinical diagnosis, but the help that can be given by laboratory investigations is clearly shown.

The book is well printed and bound, and is supplied with many illustrations and clearly constructed tables for reference. It can be recommended.

W. ROSS ASHBY.

Etudes Psychiatriques. 2 : Aspects Séméiologiques. By HENRY EY.
Paris : Brouwer & Cie, 1950.

Visitors to the International Congress of Psychiatry in Paris were impressed by the amount of serious effort and work devoted by French psychiatrists to the establishment and formulation of a theory for the foundation of psychiatric thinking and practice. One of the most profound thinkers in the field is Henry Ey, who in this second volume of his *Studies* tries to demonstrate the application of his theory to the clinical symptoms of psychiatry. The theory, which he calls "organo-dynamic," is developed from Hughlings Jackson's idea of the dissolution of function at various neuronal levels. Psychopathological symptoms can, according to Ey, only be understood as a mode of reaction of the patient's personality; the idea of clinical entities as the framework of certain symptoms is only a factor of secondary order.

A few examples will illustrate his approach to particular problems. He distinguishes a primitive memory, laid down in the nerve tissue, from a general memory tied up with intellectual processes. Disturbances of retention and evocation are regarded as disorders at the most primitive level; aphasia, agnosia and kindred symptoms as such at a somewhat higher level, but still are the result of neurological pathology. Amnesias and paramnesias, on the other hand, are part of a psychiatric disorder and inseparable from the psychotic picture; they are due to global or partial dissolution of mental activity. Catatonia, though most frequent in schizophrenia, is similarly regarded as a semiological complex. The various catatonic postures are due to cerebral processes leading to dissolution of function. This is accompanied by regression of thought and psychomotor expression to a lower and archaic pattern. When the dissolution is of a more severe degree diencephalic and mesencephalic mechanisms may become manifest. The motor automatisms of neurological character are the most elementary and basal symptoms.

While in disorders of the neurological type, such as chorea and encephalitis, the symptoms are detached from the patient's self, which remains intact, in neuroses and psychoses the personality itself is involved. Disordered modes of reaction, abnormal attitudes and impulses are part of the patients' particular way of existence in the world. This difference in relation of symptoms to the self ("moi") is one of the crucial points in Ey's teaching.

Besides the topics mentioned before, the present volume deals with exhibitionism and other sex perversions, suicide, anxiety and several forms of delusions (nihilistic, grandiose, hypochondriacal). To each of these symptoms a separate chapter is devoted in which it is followed through the different clinical manifestations. With remarkable versatility the author demonstrates how the idea of mental stratification can be made use of and applied differently to these symptoms. Moreover, his striking wealth of clinical experience and his encyclopaedic knowledge of the world literature makes the book most stimulating reading. Whatever one may think of the value of the neo-Jacksonian approach, everybody tired of the monotony of psychoanalytic interpretation and interested in a broad philosophical foundation of psychiatry will enjoy and profit from reading Henry Ey's studies. There would certainly be a public for an English translation.

R. KLIEN.

Part III.—Bibliography and Epitome.*

ACTAS LUSO-ESPAN. NEUR. PSIQ.

VOL. X.	FEBRUARY, 1951.
Speculative Interpretation of a Psychosis. <i>Schneider, K.</i>	1
Psychiatry and Endocrinology. <i>Furtado, D.</i>	4
Production and Prevention of Experimental Allergic Encephalomyelitis in Laboratory Animals. <i>Cazzullo, C. L.</i>	34
The Negro. <i>Miralles, A. G.</i>	58
Spastic Paraplegia and Bilateral Cataracts Consequent on Electric Discharge. <i>Morillas, D.</i>	69
A Contribution to the Study of the Temporal Structure of Visual Perception. <i>Hufschmidt, H. J., and Nicolau, J. del C.</i>	75

ACTA NEUR. PSYCHIAT. BELG.

VOL. LI.	FEBRUARY, 1951.
Curable Partial Atrophy of the Thenar Eminence. <i>Christopher, L., and Louis-Bar, D.</i>	63
Centro-median Medulloblastoma of the Brain of Blood-cyst Type. <i>Dereymacker, A.</i>	66
A "Silent" Choroid Angioma during Spurge-Weber's Disease. <i>Danis, P., and van Bogaert, L.</i>	74
Relations between Cranial Deformity and Skeletal, Neurological and Psychiatric Affections. <i>Liessens, P.</i>	95

MARCH.

Studies on Spasmodic Familial Paraplegia. II. <i>Appel, L., and van Bogaert, L.</i>	129
Studies on Syringomyelia. IV and V. <i>André, M.-J.</i>	167 and 178
Generalized Amyotrophy with a Myotonic Component. <i>Geets, W.</i>	186
Parkinsonian Syndrome with Amyotrophies Accompanying Lateral Amyotrophic Sclerosis and of Post-traumatic Origin. <i>Cordier, J.</i>	194
Electromyographic Repair of Myotomes in Man. <i>de Smedt, J. E.</i>	206

APRIL.

Nervous Indications of Periarteritis Nodosa. <i>Macken, Jos., et al.</i>	217
A Case of Epilepsy Caused by Sunlight. <i>Thiry, S.</i>	233
Clinical Psychoanalysis and Narcoanalysis. <i>Dagnelie, J.</i>	246
An Observation of Neurobrucellosis by Infection in a Stable. <i>Segers-Sturham, G.</i>	250
A Contribution to our Knowledge of the Etiology of Amyotrophic Lateral Sclerosis. <i>Barraquer-Ferré, L., and Barraquer-Bordas, L.</i>	264
Aggressive Behavior Prior to Delinquency in a Young Girl. <i>Schachter, M.</i>	272

ACTA PSYCHIAT. NEUR., SUPPM.

	1951.
Report on the Ninth Congress of Scandinavian Psychiatrists	No. 60
A Social Psychiatric Investigation of a Small Community in Northern Norway. <i>Brewer, J.</i>	No. 62

* A number of extracts in this section are reproduced from *Chemical Abstracts*. To the Editors of this Journal we extend our grateful thanks.

Surgical Experiments in the Therapy of Certain "Extrapyramidal" Diseases.	
<i>Meyers, R.</i>	No. 67
*Respiration Movement in Normal, Neurotic and Psychotic Subjects.	
<i>Clausen, J.</i>	No. 68
A Study in Alcoholism.	
<i>Amarh, C.</i>	No. 70
Tuberous Sclerosis and Recklinghausen's Neurofibromatosis.	
<i>Bonberg, A.</i>	No. 71
Phantom Limbs in Amputees.	
<i>Cronholm, B.</i>	No. 72

Respiration Movement in Normal, Neurotic and Psychotic Subjects.

1. Thoracic and abdominal respiratory movements have been recorded separately on five subsequent days utilizing the pneumographic recording technique on groups of normal, neurotic and psychotic subjects of both sexes. Among the normal subjects was a sub-group which had systematic physical training.

2. Some of the measures were subjected to quantitative treatment, namely breathing rate, inspiration-expiration ratio for thorax and abdomen, and variation coefficients for thoracic and abdominal breathing rate, and also for the two inspiration-expiration ratios. A number of breathing features which did not lend themselves to quantitative treatment were qualitatively evaluated by comparing the percentage distribution of the different subject groups on characteristic categories for each of these features.

3. The quantitative data show :

(a) With a time-sample of one minute for each recording day the author obtains stable data by three recordings for respiration rate and the two inspiration-expiration ratios in the normal subjects, while at least four days seem necessary in the neurotic group. The variation coefficients are highly unstable in the normal groups, but considerably more stable among the neurotics.

(b) The inspiration-expiration ratio has a higher numerical value for thorax than for abdomen.

(c) Among the normals no difference is found between the subjects with and without physical training.

(d) Among the normals men have a slower breathing rate and larger inspiration-expiration ratios than have the women.

(e) Neurotic males have a significantly faster breathing rate than normal men, and comparison between normal and neurotic females shows the same trend.

(f) Comparison of breathing rate between normal and psychotic subjects reveals the same result as the comparison between normals and neurotics. In addition, psychotic females have a significantly higher abdominal inspiration-expiration ratio than have normal females and the thoracic inspiration-expiration shows a strong tendency in the same direction.

(g) The respiration measures do not seem to be causally related to pulse rate, body temperature, or anthropometric measures like height, weight, circumference of thorax and abdomen, or Rohrer's Index.

(h) When the patients were grouped according to emotional status no difference was revealed in breathing measure between the various groups.

(i) None of the variation coefficients proved to be a useful measure in the author's group comparisons.

4. The qualitative evaluation of the curves indicated :

(a) The abdominal type of breathing is characteristic for men, and the thoracic type characteristic for women, except for psychotic women, where the abdominal type is not uncommon.

(b) In general the patients have a sharper inspiration-expiration transition in the abdominal curve than have the normals.

(c) The following features seem to differentiate between normal and neurotic subjects: regularity within one recording, expiration pauses, and similarity between the five recordings.

5. Neurosis Points have been introduced for all features differentiating between neurotic and normal subjects. Group averages for these Neurosis Points were substantially smaller in the normal groups than in the patient groups.

6. The number of Neurosis Points in an individual patient seems only in a moderate degree to reflect the severeness of the illness.

7. The results are discussed with reference to various theories where anatomical or physiological sex differences, physical exercise, mental (or emotional) status, and social norms are considered. (Author's abstr.)

AM. J. MENT. DEF.

VOL. LV.

APRIL, 1951.

Goals for the Mentally Retarded. <i>Delp, H. A.</i>	472
The Care of Mental Deficiency in Denmark. <i>Bredmose, G. V.</i>	485
Recruiting Psychiatric Aids. <i>Morgan, H.</i>	491
Development of a Curriculum for the Trainable Child. <i>Hafemeister, N. R.</i>	495
The E.E.G. in Mental Deficiency. <i>Posey, H. T.</i>	515
Glutamic Acid and Mental Deficiency. <i>Gadson, E. J.</i>	521
Kernicterus. <i>Richards, B. W.</i>	529
A Preliminary Study of Periodontoclasia in Mongolian Children at Polk State School. <i>Dow, R. S.</i>	535
Empiric Risk Figures in Mongolism. <i>Benda, C. E.</i>	539
Congenital Heart Diseases in the Feeble-minded. <i>Mautner, H.</i>	546
Psychotherapy in Relation to Mental Deficiency. <i>Neham, S.</i>	557
A Study of the Wechsler Intelligence Scale for Children with Mental Deficiency. <i>Sloan, W., and Schneider, B.</i>	573
A Study of Competitive Behavior in Mental Defectives. <i>Albee, G. W., and Pascal, G. R.</i>	576
The Fantasy Life of the Mental Defective. <i>Beier, E. G., et al.</i>	582
Correlation Analysis of Scores of Subnormal Subjects on the Stanford-Binet and Wechsler Intelligence Scale for Children. <i>Stacey, C. L., and Levin, J.</i>	590
Behavior in Intellectual Deficit. <i>Robinson, R. G., and Pasewank, R.</i>	598

AM. J. ORTHOPSYCHIAT.

VOL. XXI.

APRIL, 1951.

Psychopathic Behavior in Infants and Children. <i>Karpman, B., et al.</i>	223
The Concept of Ego Disturbance and Ego Support. <i>Redl, F.</i>	273
Investigations of Rorschach Factors in Children who have Convulsive Disorders, etc. <i>Zehrer, F. A.</i>	292
Training for Professional Function in Clinical Psychology	303
Some Considerations Relating to the Genesis of Autistic Behavior in Children. <i>Despert, J. L.</i>	335
The Neurotic Child and his Mother. <i>Sperling, M.</i>	351
Therapeutic Techniques with Emphasis on Client Participation, etc. <i>Amster, F.</i>	365
Description of a Social Service Follow-up Study. <i>Klehr, H. C.</i>	378
Adolescent Alternation of Anorexia and Obesity. <i>Berlin, I. N., et al.</i>	387

AM. J. PSYCHOTHER.

VOL. V.

JANUARY, 1951.

Public Education in Psychiatry. <i>Binger, C. A. L.</i>	4
The Popularization of Psychiatry. <i>Clark, M.</i>	16
An Experiment in Group Psychotherapy with the Narcotic Addict. <i>Johnston, McC.</i>	24
Reinforcement Therapy. <i>Freeman, M. J.</i>	32
The Factor Omnipotence in the Development of Paranoid Reactions. <i>Hyroop, M.</i>	38
The Use of Spontaneous Drawings in Group Therapy. <i>Baruch, D. W., and Miller, H.</i>	45

AM. J. PSYCHIAT.

VOL. IX.

MARCH, 1951.

Psychiatry and International Understanding. <i>Bartemeier, L. H.</i>	641
The Scientific Study of Bipolar Attitudes. <i>Lasswell, H. D.</i>	644

On Methods of the Social Sciences in their Approach to International Problems. <i>Borberg, W.</i>	650
The Contribution of History to International Understanding. <i>Ehrmann, H. M.</i>	657
National Characteristics and International Relations. <i>Klineberg, O.</i>	661
Does Failure Run in Families? <i>Ullman, A. D., et al.</i>	667
The Problem of Diagnosis in Paranoic Disorder. <i>Bonner, H.</i>	677
Examination of the Complaining Witness in a Criminal Court. <i>Ovenstein, L. L.</i>	684
Delirium. <i>Levin, M.</i>	689
Modern Psychiatric Nursing. <i>Dix, A. A.</i>	695
The Inhibition of Behaviour. <i>Cameron, D. E.</i>	701
The Conference on Psychiatric Education	706

APRIL.

The Inadequacy of Present-day Concepts of Mental Deficiency and Mental Illness in Child Psychiatry <i>Benda, C. E., et al.</i>	721
*Selective Cortical Undercutting. <i>Scoville, W. B., et al.</i>	730
Research in Private Practice. <i>Dunbar, F.</i>	739
Prophylactic Electroshock. <i>Stevenson, G. H., and Geoghegan, J. J.</i>	743
The Illness of Francis Parkman. <i>Casamajor, L.</i>	749
Clinical Reality and Projective Technique. <i>Kelley, D. M.</i>	753
Lymphocytic and Eosinophilic Reaction to E.C.T. <i>Rashin, N., et al.</i>	758
Individual Reactions to Community Disaster. <i>Tyhurst, J. S.</i>	764
Psychiatric Facilities in Cincinnati. <i>Lurie, L. A.</i>	770
Therapeutic Results and Clinical Manifestation Following the Use of Antabuse. <i>Child, G. P., et al.</i>	774
Emotional Aspects of Cardiac Disease. <i>Reiser, M. F.</i>	781

Selective Cortical Undercutting. Results in New Method of Fractional Lobotomy.

1. Complete lobotomy causes too much blunting of the personality to warrant its further use except in severely deteriorated psychotic patients.

2. Selective cortical undercutting is presented as a new method of fractional lobotomy and offers certain technical advantages over other methods, in precision, preservation of adjacent blood supply, facility and accessibility.

3. A sufficient number of undercuttings have now been done to permit specific recommendations for its therapeutic use.

4. The results of undercutting indicate that there is little specificity of the frontal lobes in their effect on psychoses but definite specificity in their effect on personality. The psychoses are favorably affected by quantitative isolation of any area of the frontal lobes. The personality is unaffected and shows little if any blunting following isolating of the orbital surface and a definite blunting upon isolation of the superior surface, similar but to a less degree to that found in a standard lobotomy.

5. There is more apparent personality deficit in non-psychotic than in psychotic patients following any type of lobotomy. Hence only fractional lobotomies should be used in patients suffering from mood disorders, neuroses or pain.

6. Undercutting of the orbital surface appears the ideal operation for psychoneuroses and milder mood disturbances because of the almost complete absence of personality change.

7. Undercutting of the superior surface or the orbital surface is recommended for the schizophrenic and severe affective psychoses, the results being roughly equal to those obtained in standard lobotomy with significantly less personality deficit.

8. Pain, if accompanied by addiction, psychalgia, or excessive anxiety, responds well to undercutting of the superior surface.

9. Undercutting of the medial, cingulate gyrus surface is technically more difficult and dangerous with inferior early and possibly equal late, results making final evaluation difficult.

10. Certain cases showing an inadequate response to selective undercutting can be converted to a more complete lobotomy as a second-stage procedure.

(Authors' abstr.)

MAY.

- *Some Experiences with Transorbital Leucotomy. *Moore, M. T., and Winkelman, N. W.* 801
- *Impaired Cerebral Functions in Essential Hypertension. *Apter, N. S., et al.* 808
- Electronarcosis in a General Hospital. *Estes, M. M., and Cleckley, H. M.* 814
- *Decamethonium Iodide (C.10) in E.C.T. *Holt, W., et al.* 821
- *Phenurone in the Treatment of Psychomotor Attacks. *De Jong, R. N.* 825
- A Clinical Evaluation of Antabuse in the Treatment of Problem Drinkers. *Bowman, K. A., et al.* 832
- The Influence of Subcortical Brain Lesions on Emotionality as Reflected in the Rorschach Color Responses. *Kral, V. A., and Dörken, H., jun.* 839
- Comments on the Psychopathology of Children with Somatic Illness. *Szurek, S. A.* 844
- *A Preliminary Report on the Use of D-Desoxyephedrine HCl in the Study of Psychopathology and Psychotherapy. *Schein, J., and Goolker, P.* 850
- Hallucinations in Migraine. *Lippman, C. W.* 856
- Psychiatric Aide Selection Through Psychological Examinations. *Barron, E. M., and Donohue, H. H.* 859
- Peptic Ulcer. *Kahn, E., and Freyhan, F. A.* 866

Some Experiences with Transorbital Leucotomy. A Review of Results in 110 Cases.

1. A series of 110 patients on whom transorbital leucotomy was performed is reported.

2. These consisted of schizophrenia 74 cases, psychoneuroses 19 cases, affective psychoses 14 cases, paranoid psychosis 2 cases, mental deficiency with paranoia 1 case.

3. The schizophrenic group had received the present-day accepted forms of treatment without relief and were considered non-salvageable, but shown a 53 per cent. improvement rate following transorbital leucotomy.

4. Catatonic and paranoid types of schizophrenia responded most favorably in this category with a 74 per cent. and 63 per cent. improvement rate respectively, whereas the deteriorating forms showed a low improvement rate of 17 per cent. If agitation was a significant feature of the deteriorated type, improvement was obtained after transorbital leucotomy.

5. Among the obsessive-compulsive patients previously subjected to psychotherapeutic techniques, E.C.T., etc., transorbital leucotomy effected an improvement in 84 per cent. Improvement was slow initially but showed increasing momentum with the passage of time.

6. Psychoneurotics with pronounced hypochondriacal preoccupations are not favorably influenced by transorbital leucotomy.

7. The affective psychoses, wherein repeated courses of shock therapy have failed to prevent frequent recurrences, particularly agitated depressions, respond very favorably to transorbital leucotomy, an improvement rate of 83 per cent. appearing in the manic-depressives, and 63 per cent. in the involutional depressions.

8. In view of the relative ease of performance, short hospitalization, minimal nursing care, insignificant morbidity, low mortality compared with other psychosurgical procedures, and the favorable results, the authors suggest that this procedure be utilized more widely in suitable cases before relegating them to custodial institutions for life, or permitting them to lead a burdensome existence.

(Authors' abstr.)

Impaired Cerebral Functions in Essential Hypertension.

1. The cerebral course of essential hypertension is reviewed.

2. The psychiatric syndrome, characterized by changes in personality patterns, especially in relation to the expression of hostility, the willingness to yield to dependent needs, and reduction in perfectionistic drives, associated with mild judgmental and memory defects, insomnia, loss of energy and anxiety symptoms that are not explainable by changes in the cardiovascular status, has been isolated by the combined techniques of the internist, psychiatrist, neurologist and experimental psychologist. The appearance of this syndrome signifies the onset of

organic involvement of the brain. The duration of the syndrome depends not so much upon the quantitative aspects of the cerebral damage as upon the integrative ability of the premorbid personality.

3. Impairment of cerebral functions equivalent to that seen in patients with surgical removal of both frontal lobes may occur early in the course of essential hypertension without neurological signs. Although the critical experimental psychological tests used in the authors' study measure functions of the prefrontal lobes, the authors do not presume that brain damage is confined to this area. On the contrary, neuropathological evidence points to diffuse involvement of the nervous system.

4. The syndrome described that accompanies the onset of brain disease provides further information regarding the clinical course of hypertension. The authors' study does not provide information relative to its incidence nor the factors that promote or retard its appearance.

5. The mechanism by which cerebral damage herein described occurs requires further elaboration. The discrepancy frequently encountered between disturbances and adaptive capacities and the absence of neurological signs invokes a concept of neuropathology that considers alterations in vasomotricity and subtle biochemical changes.

(Authors' abstr.)

Decamethonium Bromide (C-10) in Electric Convulsive Therapy.

Twenty-one mental patients were given decamethonium bromide to modify electric convulsive response. A dose of 4 mg. or above was necessary to prevent aggravation of pre-existing traumatic injury. Respiratory paralysis is regularly present when doses of 4 mg. or above are given. Pentothal sodium is useful to allay fear occasioned by muscle paralysis, but in sensitive persons pentothal may produce laryngeal spasm. Training in pentothal anesthesia and oxygen administration to unconscious patients is needed by the therapist wishing to use decamethonium bromide for the more serious physical contraindications to E.C.T. The therapeutic effect of E.C.T. is not interfered with by decamethonium bromide modification of the seizure. Decamethonium bromide is a powerful and potentially dangerous drug, but it is of great value when skilfully used in trained hands.

(Authors' abstr.)

Phenurone in the Treatment of Psychomotor Attacks.

During the past 2 years phenurone (phenacetylurea) has been administered to 59 patients whose presenting complaint was psychomotor epilepsy. In 17 of these patients (29 per cent.) the psychomotor attacks occurred without other manifestations of epilepsy; in 42 (71 per cent.) there were associated *grand mal* and/or *petit mal* seizures. The medication was discontinued because of the development of toxic symptoms in 15 patients (25.3 per cent.); it failed to help in 4 patients (6.7 per cent.); it was discontinued for other reasons in 12 patients (20.2 per cent.). In the remaining 28 patients (47.8 per cent.) phenurone, with or without other anticonvulsants, brought about the most complete control of attacks that the patients had experienced to date, and every patient had been tried on almost every known drug used for the treatment of epilepsy before the institution of phenurone therapy. In 74 per cent. of these patients the attacks are under complete control, and in the remaining 25 per cent. they are 75 per cent. to 90 per cent. controlled.

Phenurone should be considered an important addition to the drugs used for the treatment of epilepsy, especially psychomotor seizures, which respond poorly to other medication. Its use is not without danger, but serious toxic results are infrequent. The most common untoward symptoms associated with its use appear in the first few days of treatment, and indicate immediate withdrawal of the drug. Patients receiving phenurone should be watched carefully for the possible development of damage to the hematopoietic system and to the liver; withdrawal of the medication is indicated as soon as these appear. An acute toxic hepatitis occurred in one instance in the author's series. The psychological changes reported in patients with psychomotor epilepsy who are receiving phenurone were encountered in only one instance (the same patient), and he may have had what should be diagnosed as a toxic psychosis superimposed upon a schizoid psychopathy. It is

possible that the reported psychologic symptoms are associated with psychiatric changes secondary to discharging temporal lobe lesions. The majority of the author's subjects, who are ambulatory patients of the neurologic clinic of the University Hospital, failed to show significant personality abnormality before the institution of therapy and showed no changes thereafter.

Although phenurone must always be administered with caution and discretion, and patients who receive it must be followed carefully, it is considered to be no more toxic than many other therapeutic agents. It is capable of relieving certain patients of seizures that are not affected by other anti-epileptic drugs. It is of such definite value in the treatment of psychomotor epilepsy that it is hoped that it will soon be available for general use. It is believed that the warnings of the manufacturer should at all times be borne in mind, however, and that treatment with phenurone should be instituted only by a physician experienced in the therapy of epilepsy. It should be employed with caution in patients who have previously shown personality disorders, and it may be advisable to hospitalize such patients during the first weeks of treatment. The patient and his family should be instructed to watch for changes in behavior, evidences of gastrointestinal disturbance or jaundice, rash and fatigue and report these to the physician immediately. The most serious complications, which should be kept in mind, include aggravation of pre-existing personality abnormality, hepatic damage and bone marrow depression. (Author's abstr.)

A Preliminary Report on the Use of D-Desoxyephedrine Hydrochloride in the Study of Psychopathology and Psychotherapy.

1. D-desoxyephedrine hydrochloride was employed intravenously in an intensive study of 22 patients with psychoneurotic illness.
2. It was found invaluable as a working tool for :
 - (a) The delineation of defenses available to the patient, and the role of this delineation in diagnosis and research.
 - (b) A Nosological differentiation in so-called "borderline" syndromes.
 - (c) The vivid clarification of transference reactions.
 - (d) The unexpected confrontation of the alert patient with a dramatic change in his chronic symptoms, and its consequent impetus toward recovery.
 - (e) The marked reduction in time consumed in obtaining valuable conscious and preconscious material.
3. A repeated phenomenon, which the authors have labelled "reawakening of focal memory" has been frequently observed, and represents a challenge to the study of recall and psychic representation.
4. It allows for clearly observable phenomena even in the presence of a group, and thus affords an excellent medium for teaching purposes.

(Authors' abstr.)

JUNE.

Clinical Language Rehabilitation of the Veteran. <i>Freud, E. D.</i>	881
Emotional Problems of Maladjustment in Children with Reading Difficulties. <i>Odenwald, R. P., and Shea, J. A.</i>	890
Inference Testing in Psychotherapy. <i>Reid, J. R., and Finesinger, J. E.</i>	894
Psychiatric Symptoms and Syndromes in Parkinson's Disease. <i>Schwab, R. S., et al.</i>	901
Electromyographic Recording During Interview. <i>Davis, F. H., and Malmo, R. B.</i>	908
The Hypnotic and Hypnotherapeutic Control of Severe Pain. <i>Rosen, H.</i>	917
Prognoses and Psychological Scores in E.C.T., etc. <i>Scherer, I. W.</i>	926
Sterilization in Preventive Psychiatry. <i>Gamble, C. J.</i>	932

AM. PRACTIT.

VOL. II.

MARCH, 1951.

Hospitalization in Treatment of Neuroses. <i>Smith, H. B., and L. H.</i>	241
The Emotional Significance of Cancer. <i>Shands, H. C., et al.</i>	261

MAY.

An Acute Psychosis with A.C.T.H.	<i>Frank, J. A.</i>	400
Problems and their Management in Central Nervous System and Cardio-vascular Syphilis.	<i>Packer, H.</i>	422

JUNE.

Shock Treatments in Psychiatry.	<i>Karliner, W.</i>	511
Tracheotomy in Barbiturate Poisoning.	<i>Lewy, R. B., and Sibbitt, J. W.</i>	527

ANN. MÉD.-PSYCHOL.

VOL. CIX.	FEBRUARY, 1951.
Psychotic Forms of Meningo-neuro-brucellosis.	<i>Roger, H., and Poursines, Y.</i> 145
The Affective Theory of Hallucinations.	<i>Alves Garcia, J.</i> 170

MARCH.

Temporal Hallucinations.	<i>Cossa, P., and Martin, P.</i>	273
Practical Application of Szondi's Test.	<i>Stumper, E.</i>	281
Acid-base Equilibrium in Mental Diseases.	<i>Leyritz, J.</i>	309

APRIL.

The Hypothalamus and Mental Illness.	<i>Abely, P.</i>	417
Progressive General Paralysis in the Native Musselman of North Africa.	<i>Marill, F-G., and Si Hassen, A.</i>	435

MAY.

Reflection on the Significance of Lobotomy.	<i>Wertheimer, P., and Angel, J.</i>	537
The Psychological Functions of the Cinema.	<i>Deshaiés, G.</i>	553
Pick's Disease.	<i>Schenk, V-W-D.</i>	574

ARCH. NEUR. PSYCHIAT.

VOL. XLV.	MARCH, 1951.
Third Ventriculostomy in Treatment of Obstructive Hydrocephalus in Children. <i>Voris, H. C.</i>	265
E.E.G. and Cortical Electrograms in Patients with Temporal Lobe Seizures. <i>Jasper, H., et al.</i>	272
*Permanency of Glutamic Acid Treatment. <i>Zimmerman, F. T., and Burge-meister, B. B.</i>	291
The Syndrome of Crocodile Tears. <i>Chorobski, J.</i>	299
Pain Below the Level of Injury of the Spinal Cord. <i>Pollock, L. J., et al.</i>	319
*Prognosis in Topectomies and Lobotomies Relative to Body Type. <i>Kline, N. S., and Tenney, A. M.</i>	323
*Studies on the Iron Content of C.S.F. in Different Psychotic Conditions. <i>Lehmann, H. E., and Kral, V. A.</i>	326
The Palmomental Reflex. <i>Blake, J. R., and Kunkle, E. C.</i>	337
Occlusion of the Internal Carotid Artery. <i>Fisher, M.</i>	346

Permanency of Glutamic Acid Treatment.

The authors' results show a considerable degree of permanency after glutamic acid treatment has been discontinued over a period of years, with many patients holding their gains on the intelligence test remarkably well. Their data indicate that amount of gain on the verbal intelligence test is of greater importance in determining the permanency of effect than is length of treatment. Performance test findings, however, favor length of treatment as a positive factor determining the degree of permanency.

The results of investigators who have obtained negative results with the administration of glutamic acid can be explained by the lack of technical precision,

both in the proper administration of the drug and in experimental accuracy. When these factors have been handled adequately, results similar to the authors' have been obtained, both in the human and in the animal fields. The latter is well demonstrated by Albert and Warden in a study in which a problem box much more elaborate than the authors' maze was used. This particular experiment has never been challenged, or even repeated. Among psychologists, of course, it is well known that problem box work is much more laborious and time-consuming than are the relatively rapid maze experiments. (Authors' abstr.)

Prognosis in Topectomies and Lobotomies Relative to Body Type.

If the patient subjected to either a topectomy or a lobotomy is not a mesomorph, the prognosis for a favorable outcome is less than 1 in 10. Of the 13 nonmesomorphs operated on in the authors' series, only one was discharged. On the other hand, four of the five mesomorphs in their series who had either lobotomy or topectomy have been discharged, and the remaining patient (with lobotomy) was on trial visit but has been at least temporarily returned to the hospital. The use of psychosurgical procedures on nonmesomorphs should be undertaken with caution. (Authors' abstr.)

Studies on the Iron Content of Cerebrospinal Fluid in Different Psychotic Conditions.

1. The iron content of the cerebrospinal fluid of 98 patients committed to a hospital for mental disease is examined.

2. The relation of the iron content of the brain to that of the spinal fluid is discussed.

3. When the patients were divided into various diagnostic groups, a statistically significant difference between the spinal fluid iron of the acute and that of the deteriorated schizophrenic patients appeared. The difference between the spinal fluid iron of the group with organic psychoses and that of the group with acute schizophrenia was very significant.

4. It is assumed that a low iron content of the spinal fluid is indicative of increased brain metabolism and that high iron values of the spinal fluid may reflect reduced cellular activity of the brain tissue. (Authors' abstr.)

APRIL.

Standing Potential Correlates of Hypnosis and Narcosis.	<i>Ravitz, L. J.</i>	413
Visual and Motor Changes in Patients with Multiple Sclerosis.	<i>Guthrie, T. C.</i>	437
Tremor in Parkinson's Disease and its Inhibition by Amyl Nitrite.	<i>Garai, O.</i>	452
Deaths Related to Pneumoencephalography During a Six-year Period.	<i>Whittier, J. R.</i>	463
Interaction in Bilaterally Simultaneous Voluntary Motor Function.	<i>Cohn, R.</i>	472
Migraine and Other Head Pain.	<i>Blumenthal, L. S., and Fuchs, M.</i>	477
An Assessment of Therapy in Parkinson's Disease.	<i>Schwab, R. S., and Prichard, J. S.</i>	489
A New Procedure for Activated E.E.G.	<i>Negrin, J., jun.</i>	502
An Improved Technic for Percutaneous Cerebral Angiography.	<i>Donald, D. C., jun., et al.</i>	508
The Mechanism of Chvostek's Sign.	<i>Kugelberg, E.</i>	511

MAY.

*Intellectual and Emotional Make-up of the Epileptic.	<i>Zimmerman, F. T., et al.</i>	545
*Psychological Effects of Chronic Barbiturate Intoxication.	<i>Kornetsky, C. H.</i>	557
Studies on Headache.	<i>Schumacher, G. A., and Guthrie, T. C.</i>	568
*Experimental Physiological Studies with Lysergic Acid Diethylamide (L.S.D.-25).	<i>Forrer, G. R., and Goldner, R. D.</i>	581
Significance of Rise in Blood-Sugar Level after Injection of Epinephrine in Mental Disease.	<i>Altschule, M. D., et al.</i>	589

- Traumatic Neurosis, Compensation Neurosis or Attitudinal Pathosis. *Kamman, G. R.* 593
- A Dynamic Factor Correlated with the Prognosis in Paranoid Schizophrenia. *Seitz, P. F. D.* 604
- *The Phenomena of Sensory Displacement. *Bender, M. B.* 607
- Reflexes Evoked by Cold Stimuli in Injuries of the Spinal Cord. *Pollock, L. J., et al.* 622
- Subarachnoid Hemorrhage in Melanoma of the Brain. *Madonick, M. J., and Savitsky, N.* 628

Intellectual and Emotional Make-up of the Epileptic.

The authors' findings indicate that a relationship exists between the degree of disturbance in conscious awareness and the adequacy of mental functioning in groups of epileptic patients.

An etiological classification based on commonly-accepted clinical seizure types reveals differences in intelligence and personality in these groups of epileptic patients.

Petit mal epilepsy, with its transitory lapses of consciousness and relatively mild clinical manifestations, shows the highest intelligence quotient and the least amount of personality deviation among children and adults, whereas in the severer types of seizures the intelligence quotient is lowered and productiveness is more curtailed.

The intelligence quotient is higher among children if the onset of the *grand mal* seizure appears late than if it appears early in the child's life.

The authors' Rorschach records seem to demonstrate some degree of "organicness," even among the idiopathic types, interference with mental functioning being most pronounced in the authors' groups with symptomatic and traumatic epilepsy.

All these conclusions are made possible by a method of classification which utilizes finer degrees of differentiation than the older dichotomy of "organic-non-organic" epilepsy. (Authors' abstr.)

Psychological Effects of Chronic Barbiturate Intoxication.

1. Five former morphine addicts, who volunteered for the experiment, were given sufficiently large doses of secobarbital, pentobarbital or amobarbital to induce continuous mild to severe intoxication for periods varying from 92 to 144 days. Six tests were used in an attempt to measure psychological changes during intoxication with abrupt withdrawal from the barbiturates. Three of the tests were administered routinely, the Digit-Symbol, the Bender Gestalt and the Draw-a-Man test. Three of the tests, the Rorschach, Stanford-Binet and Kohs Block tests, were administered only during specified periods of the study.

2. During the chronic intoxication period there was a quick decline in ability, followed by an increase in efficiency, which became maximal 30 to 70 days after the start of continuous medication. In only one instance was a score attained which was higher than control scores obtained after recovery from chronic intoxication. One of the subjects showed gradually increased efficiency on the Digit-Symbol tests from the very onset of chronic drug administration.

3. Oral administration of secobarbital, pentobarbital and amobarbital produced greatest impairment in performance of tasks involving speed, less impairment in tasks involving copying and least in tasks requiring production of behavior that had been stabilized in the past experience of the subject.

4. There were quantitative and qualitative differences in the effects of barbiturates on different subjects, and the same dose of a barbiturate affected the same subject differently on different days.

5. During chronic barbiturate intoxication, there was a partial loss of ego control, which was manifested by a greater magnitude of pathological personality projection in the projective techniques used. This trend became more pronounced as intoxication continued.

6. When the administration of barbiturates was discontinued, the performance of the subjects quickly reverted to the preaddiction level. No evidence of residual physical damage could be detected.

7. The results of Rorschach examinations obtained during the withdrawal from barbiturates, while the patients were psychotic, were very different from those obtained during the other periods of the experiment. The form level was comparatively low; bizarre responses were present; stereotypy (A per cent.) increased, and the number of popular responses decreased.

8. It was observed that the preaddiction Rorschach patterns of the three subjects in whom major psychoses developed after abrupt withdrawal of barbiturates were characterized by high percentage of F + responses and deficiency in affect and fantasy. In the other two patients, the percentage of F + responses was low, and percepts related to affect or fantasy were present. The possible relations of these findings is discussed with reference to the susceptibility of certain personality types to the development of psychoses in reaction to the stress of barbiturate withdrawal. (Author's abstr.)

Experimental Physiological Studies with Lysergic Acid Diethylamide (L.S.D.-25).

Studies with lysergic acid diethylamide (L.S.D.-25) have been carried out in an effort to clarify the physiological and psychic responses attendant on administration of this drug in schizophrenic patients. The drug produced slight increase in blood pressure, slight increase in pulse rate, no essential change in respiration, increase in salivation and lacrimation, dilatation of the pupils, increase in deep reflexes and slight ataxia. Oral administration produced pupillary dilation of marked degree, whereas topical administration produced very slight dilation. The total white blood cell count was increased during the time of action of the drug. Euphoria occurring in outbursts, was prominent. Increased accessibility and amiability, with increased release of libido and greater accessibility of delusional material, was observed. Visual hallucinations of the so-called primary type were not noted in two blind patients treated with the drug but were seen in all of the six patients on whom complete studies were carried out. Urinary constituents, the non-protein nitrogen level, the electroencephalogram, cephalin-cholesterol flocculation, weight and temperature were not affected by the administration of this drug in doses up to 6 micrograms per kilogram. Lysergic acid diethylamide appears to be a suitable substance for further therapeutic investigation in the psychoses. (Authors' abstr.)

The Phenomenon of Sensory Displacement.

Observations on patients with the method of simultaneous stimulation of the face and hand disclosed two types of abnormal responses: (a) imperception of the hand stimulus and (b) mislocalization of the hand stimulus.

The mislocalization showed direction and predictability. For this reason this effect has been called the phenomenon of displacement.

The displacement occurred (a) in an ipsilateral direction, this being the most frequent type, (b) in a contralateral direction, or (c) outward into the extra-personal space, this being the least frequent type.

The direction of the ipsilateral displacement was usually toward the "dominant" sensory region. The direction of contra-lateral displacement was away from the "bad" or hypesthetic, side of the contralateral (normal) regions. In general the direction of the displacement was determined by the degree of dominance of the sensory areas tested. The order of dominance was established after numerous combinations of simultaneous stimulation of two different regions of the body. The face was most dominant, whereas the hand was least dominant.

The phenomenon of displacement was found not only in patients with disease of the brain but also in patients with disease of the spinal cord. Most significant is the observation that the phenomenon of displacement occurs in a small percentage of normal adults, in a high percentage of normal adults during the period of recovery from anesthesia and in a high percentage of normal young children.

The significance of the phenomenon of displacement is the same as that of extinction. The occurrence of the phenomenon of displacement or extinction suggests that a sensation evoked by one stimulus is constantly influenced by other stimuli. Perception is organized in characteristic patterns. The pattern found in patients with disease of the nervous system is the same as that which one may observe in the normal subject. (Author's abstr.)

ARCH. PSICOL. NEUR. PSICHIAT.

VOL. XII.

FEBRUARY, 1951.

Some Aspects of Psychology in the U.S.A. <i>Dalla Volta, A.</i>	1
The Function of Rhythm. <i>Walter, L.</i>	23
Modification of the Lamparter Test and the First Results of the Application in Neuro-psychiatry. <i>Sanguineti, J., and Sigurta, R.</i>	35
The Interpretative Process in the Rorschach Test. <i>de Franco, F.</i>	53
Some Cases of Psychoneurotic Reactions with Operative Intervention. <i>Gervasio, L.</i>	70

BRAIN.

VOL. LXXIII.

1950.

Blood Pyruvate Estimations in the Diagnosis and Treatment of Polyneuritis. <i>Joiner, C. L., et al.</i>	431
*Fits of Laughter in Organic Cerebral Disease. <i>Martin, J. P.</i>	453
The Cerebral Basis of Consciousness. <i>Brain, W. R.</i>	465
A Comparison of the Sensory Dissociation Produced by Procain and by Limb Compression. <i>Sinclair, D. C., and Hinshaw, J. R.</i>	480
Symptomatic "Cataplexy" or Chalcistic Fits in Cortical Lesion of the Frontal Lobe. <i>Ethelberg, S.</i>	499
Further Studies on the Role of Proprioception in Cortically Induced Movements of the Foreleg in the Monkey. <i>Gellhorn, E., and Johnson, D. A.</i>	513
A Study of Retrograde Degeneration in the Oculomotor Nucleus of the Rhesus Monkey. <i>Warwick, R.</i>	532

Fits of Laughter (Sham Mirth) in Organic Cerebral Disease.

Four cases are described in which attacks of laughter occurred in association with organic cerebral disease, and similar cases from the literature are quoted. The episodes of laughter are considered to be fits comparable with Jacksonian (motor or sensory) fits.

The patient's emotional state at the time of such an attack is not that appropriate to laughter—the apparent mirth is "sham."

In every case in which there were indications of the site of the lesion it was so placed that it might affect the hypothalamus, and these cases give practical support to the view that the motor centre for laughter is situated in or near the hypothalamus.

The observations on the patients' emotional states suggest that the centre which discharges is a motor centre and not one exciting emotion.

The attacks of laughter in most of the cases were of evil omen.

(Author's abstr.)

VOL. LXIV.

1951.

The Surgical Treatment of Colloid Cyst of the Third Ventricle. <i>McKissock, W.</i>	1
The Effects of BAL in Hepatolenticular Degeneration. <i>Cummings, J. N.</i>	10
Colloid Cysts of the Third Ventricle. <i>Kelly, R.</i>	23
*Corticofugal Connexions of Posterior Orbital Surface in Rhesus Monkey. <i>Wall, P. D., et al.</i>	66
Nervous and Mental Disorders in Cushing's Syndrome. <i>Spillane, J. D.</i>	72
Hyaline Bodies in the Optic Discs. <i>Chambers, J. W., and Walsh, F. B.</i>	95

Corticofugal Connexions of Posterior Orbital Surface in Rhesus Monkey.

Lesions were made in the posterior orbital surface of three monkeys (*Macaca mulatta*). The animals were sacrificed ten days after the operation and fine-fibre degeneration was investigated by a silver staining method. Direct projections were shown from the orbital surface to the ventromedial and the paraventricular nuclei of the hypothalamus and to the caudate nucleus. Physiological work on the significance of these projections is discussed.

(Authors' abstr.)

BR. J. EDUC. PSYCHOL.

VOL. XXI.

JUNE, 1951.

- The Responses of Adolescent Groups to Certain Films (Part II). *Wall, W. D., and Simson, W. A.* 81
- Factors in the Appreciation of Poetry. *Gunn, D. G.* 96
- A Note on Practice Effects in Intelligence Tests. *Peel, E. A.* 105

BR. J. MED. PSYCHOL.

VOL. XXIV.

JUNE, 1951.

- Some Observations on the Self in Childhood. *Fordham, M.* 83
- Notes Regarding the Dynamics of the Self. *Adler, G.* 97
- On Talking or the Communication of Ideas and Feelings by Means of Mainly Audible Symbols. *Stein, L.* 107
- The Testing of Abstraction, with Special Reference to Impairment in Schizophrenia. *Hall, K. R. L.* 118
- Recent Research on the Porteus Maze Test and Psychosurgery. *Porteus, S. D.* 132
- A Note on the Reliability of the Szondi Test. *Sandler, J., and Lubin, A.* . 141

BRIT. J. PSYCHOL.

VOL. XLII.

MARCH AND MAY, 1951.

- The Perception of Error. *Postman, L., et al.* 1
- The Role of Depth of Focus in Depth Perception. *Howarth, E.* 11
- The Fitness of Signs to Words. *Hall, K. R. L.* 21
- Anticipation in Memorizing. *Kay, H., and Poulton, E. C.* 34
- The Experimental Study of the Transmission of Rumour. *Higham, T. M.* . 42
- A Study of German and English Teacher-training Students by Means of Projective Techniques. *Kaldegg, A.* 56
- Primary Social Attributes and the "Social Insight" Test. *Eysenck, H. J.* . 114
- The Ability of the Gurkha Recruit. *Warburton, F. W.* 123
- Orientation in the Mole-rat *Cryptomys*. *Eloff, G.* 134
- The Effect of Infant Food-deprivation upon Adult Hoarding in the White Rat. *Albino, R. C., and Long, M.* 146
- Note on a "New" Non-verbal Intelligence Test Item. *Peggs, A. D.* . . . 177

BULL. LOS ANGELES NEUR. SOC.

VOL. XVI.

APRIL, 1951.

- Injuries to the Skull and Brain in Oceania. *Courville, C. B.* 14
- Cerebral Hemispherectomy. *Crockett, H. G., and Estridge, N. M.* 71
- Carotid Cavernous Communications. *Mense, J. S.* 88
- Injuries of the Nervus Radialis. *Seletz, E.* 109
- Pneumoencephalography in Children. *Anderson, F. M.* 125
- Stab Wounds of the Skull and Brain. *Andler, M.* 137
- The Surgical Treatment of Intracranial Aneurysms. *Dueker, H. W.* . . . 150
- Abscess of the Brain. *Cuneo, H. M.* 162
- Spontaneous Intracerebral and Cerebellar Hematoma. *Werden, D. H.* . . 174
- Stainless Steel Cranioplasty. *Adelstein, L. J.* 185
- Post-traumatic Headache. *Raney, A. A.* 209

CERVELLO.

VOL. XXVII.

MARCH, 1951.

- Acetylcholine in the C.S.F. in Cases of Mental Disease. *Poloni, A.* 81
- The Amount of Prothrombinemia in Vascular Syndromes of the Brain, also its Relation to Various Treatments. *Rossini, R., and Cavalca, G. C.* . 105

MAY.

- Paranasal Sinus Disease and Central Neuropathy. *Cacciapuoti, G. B.* . . 161
- Post-traumatic Amyotrophic Lateral Sclerosis. *Volpe, A.* 170

- Environmental Factors and their Ultimate Relation to the Pathogenesis of the Syndrome Called "Lipo-fibro-calcareous Myopathy." *Mattioli-Foggia, C.* 192
 The Action of Dicoumarin on the Vessels of Nervous Tissue During Acute Experimental Intoxication. *Rossi, L.* 201

CONF. NEUROL.

- VOL. XI. 1951.
 Lymphangioma of the Nervous System. *Krayenbuhl, H., and Klinger, M.* 65
 Ultraspectrophotometry of C.S.F. in Tumours of the C.N.S. *Spiegel-Adolf, M., and Wycis, H. T.* 87
 Impedance of the Human Head as Observed during E.C.T. *Umlauf, C. W., et al.* 129
 Pericapillary Astrocyte Nests of the Cerebral Cortex in Cerebral Arteriosclerosis. *Wildi, E.* 139
 Acute Hypothalamic Discharge in Man Due to Scorpion Stings. *Efrati, P.* 152
 Chronic Vascular Headache Treated by Intense Histamine Therapy. *Kajtor, F.* 167

DIS. NERV. SYST.

- VOL. XII. FEBRUARY, 1951.
 Psychopenetration. *Wilcox, P. H.* 35
 The Relation of the Family to Manic-depressive Psychosis. *Finley, C. B., and Wilson, D. C.* 39
 Evaluation of Air Studies. *Reitman, F.* 44
 Two Years' Report of a Veterans' Administration Travelling Mental Hygiene Clinic. *Lombard, E. F., and St. Clair, W. F.* 46
 Medical Contraindications to the Use of Sodium Pentothal for Narcosynthesis. *Tilkin, L.* 57

MARCH.

- Intravenous Pervitin and the Psychopathology of Schizophrenia. *Hope, J. M., et al.* 67
 Seizure Patterns in Psychomotor Epilepsy. *Golub, L. M., et al.* 73
 Withdrawal Effects of Sodium Amytal. *Alexander, E. J.* 77
 Dramamine in the Prevention and Treatment of Nausea and Vomiting Following E.C.T. *Kerman, E. F.* 83
 Paget's Disease Complicated by Recurrent Extradural Hematoma. *Peachey, W. G.* 86
 Child Admissions to a Receiving Hospital. *Wallinga, J. V., and Bachrach, A. J.* 90

APRIL.

- Further Clinical Investigation of Tolserol. *Hecker, A. D., et al.* 99
 Nutrition Applied to Clinical Psychiatry. *Moriarty, J. D.* 105
 Application of Psychologic and Psychiatric Principles in the Army Leadership Program. *Wilkinson, W. E.* 110
 Influence of Benadryl upon Electromyographic Recordings in Parkinsonism. *Gitt, J. J., et al.* 117
 An Elaboration of a Distinctive E.E.G. Pattern Found during Drowsy States in Children. *Dale, P. W., and Busse, E. W.* 122

MAY.

- Clinical Diagnosis of Periarteritis Nodosa. *Millikan, C. H.* 131
 Group Psychotherapy by Nurses and Attendants. *Kaldeck, R.* 138
 Relief of Myopia by Hypnosis and Eye Training. *Le Cron, L. M.* 142
 Regressive Shock Therapy in Schizophrenia. *Rothschild, D., et al.* 147

EEG CLIN. NEUROPHYSIOL.

VOL. III.

FEBRUARY, 1951.

- *Stimulation Studies of the Prefrontal Lobe and Uncus in Man. *Liberson, W. T., et al.* 1
- *E.E.G. Findings in 186 Cases of Chronic Post-traumatic Encephalopathy. *Clark, E. C., and Harper, E. O.* 9
- *The Incidence of Focal and Non-focal Abnormalities in Clinical Epilepsy. *Kershman, J., et al.* 15
- Servo-motor Integration of the Electrical Activity of the Brain and its Applications to the Automatic Control of Narcosis. *Verzeano, M.* 25
- *Drug Effects on the Results of Minimal Cortical Stimulation. *Whielson, J. A., and van Harreveld, A.* 31
- *Physiological Relationships between Hypothalamus and Cerebral Cortex. *Ingram, W. R., et al.* 37
- The E.E.G. Findings in 39 Surgically Proven Subdural Hematomata. *Friendlander, W. J.* 59
- *The Effect of Benzedrine on the Post-electroshock E.E.G. *Lennox, M. A., et al.* 63
- *Comparative Effectiveness of Sleep and Metrazol-activated E.E.G. *Merlis, J. K., et al.* 71

Stimulation Studies of the Prefrontal Lobe and Uncus in Man.

1. Electric stimulation of the uncus, cingulate, orbital and superior surface areas of the prefrontal cortex has been carried out in conscious man with special reference to its effect on respiration, state of consciousness and seizures.

2. Studies were made on 24 patients while undergoing selective cortical undercutting in various areas of the frontal lobes for mental disease.

3. Meager changes were noted following stimulation with high voltage and long duration of the cingulate, orbital and superior surface areas of the prefrontal lobes. In one case, stimulation of the cingulate surface produced a marked quieting effect on an agitated patient.

4. Profound changes in respiration, state of consciousness and delayed appearance of seizures followed stimulation of the uncus with relatively low voltage and short duration.

5. The uncus effects appear to be cumulative and when once initiated may continue for variable periods of time. (Authors' abstr.)

Electroencephalographic Findings in 186 Cases of Chronic Post-traumatic Encephalopathy.

1. A significant shift toward abnormal diffuse and focal types of E.E.G. was found in comparing 186 head injuries with the 1,000 normal controls of Gibbs.

2. There was a pronounced change from the "normal" to the "focal" electroencephalogram as one moved from the "closed" through the "open, non-penetrating" to the "open, penetrating" group of head trauma.

3. E.E.G.s in cases of "open, penetrating" head wounds without localizing neurologic findings were as likely to be abnormal as those with such signs.

4. Of the "focal" tracings 24 or 77 per cent. (86 per cent. in the "open, penetrating" series) corresponded to the site of the wound. Of the remaining 8 cases, 6 satisfied most of the requirements for "contre-coup" injury.

5. In this series the electroencephalogram did not reveal, with any degree of accuracy, those patients who had had convulsions prior to the tracing.

(Authors' abstr.)

The Incidence of Focal and Non-focal E.E.G. Abnormalities in Clinical Epilepsy.

1. A group of patients with clinical epilepsy have been studied in various centres across Canada.

2. In 428 civilian patients, 38 per cent. had focal E.E.G. abnormalities.

3. In 262 veterans and service patients who were carefully studied, 66.5 per cent. had focal E.E.G. abnormalities.

4. In another group of 175 veterans, 39.5 per cent. had focal E.E.G. abnormalities.

5. In the total series of 865 patients, 47 per cent. had focal E.E.G. abnormalities.

6. This figure was identical with the percentage of focal E.E.G. abnormalities found in 2 previous groups of patients studied at the Montreal Neurological Institute.

7. In a total of 2,648 patients with clinical epilepsy, focal E.E.G. abnormalities were the largest single group of E.E.G. disturbances.

8. The percentage of focal disturbances uncovered depends to a considerable extent on the technique and care used in doing localization studies.

9. Eighty-one per cent. of patients with clinically focal seizures had a focal E.E.G. abnormality.

10. Although 80 per cent. of patients with *petit mal* attacks had bilaterally synchronous E.E.G. disturbances, the latter also occurred in 53 per cent. of patients who had *grand mal* attacks only. This form of discharge therefore, although commonly seen in *petit mal*, is by no means pathognomonic. Nor is it only seen in idiopathic epilepsy, though they are very frequently associated.

11. Diffuse dysrhythmias were most frequently associated with patients who had only *grand mal* seizures.

12. Bilaterally synchronous disturbances were much more common in patients whose seizures began before the age of 25 years.

13. Focal E.E.G. abnormalities were much more common in patients over 25 years of age and particularly if the attacks began after the age of 25 years.

14. Diffuse dysrhythmias were evenly distributed in all age groups.

15. Borderline or normal E.E.G. records were seen more frequently in patients with *grand mal* attacks only and in older patients particularly after the age of 56 years.

16. The lowest percentage of normal and borderline records were seen in patients with *petit mal* and in infants and young children. (Authors' abstr.)

Drug Effects on the Results of Minimal Cortical Stimulation.

The effects were investigated of a number of anti-convulsants upon the spread of depression and "convulsoid activity" induced by minimal cortical stimulation.

Pentobarbital decreased the wave frequency of the convulsoid activity, increased the threshold of stimulation for Leão's spreading depression and decreased the rate of propagation of this phenomenon. In small doses it "improved" the pattern in between stimulation (interim pattern). Phenobarbital had a similar, although less pronounced effect on the convulsoid activity and on the interim pattern as Pentobarbital. It did not influence the threshold or rate of spread of Leão's depression. Mebaral curtailed the convulsoid activity in small doses. Tridione had no effect on any of the results of cortical stimulation investigated. Mesantoin suppressed the convulsoid activity in rather small doses. Dilantin slowed down the wave frequency of the convulsoid activity, but did not suppress this phenomenon even in relatively large doses. It did not affect the threshold or rate of spread of Leão's depression. The interim pattern deteriorated after the administration of Dilantin. (Authors' abstr.)

Physiological Relationships between Hypothalamus and Cerebral Cortex.

1. After small bilateral hypothalamic lesions which produced affective behavior changes, the E.C.G. was usually of fast normal type. In some animals, affect-evoking stimuli produced alerting patterns with subsequent rhythmic slow waves, followed again by fast activity.

2. After lesions which were primarily restricted to the posterior hypothalamus, but which involved upper midbrain, the animals developed catalepsy, there were rhythmic bursts of high voltage slow waves, and alerting was difficult. After several days recovery, alerting was readily possible.

3. After massive bilateral hypothalamic destruction, the dominant frequencies shifted to the slow bands, and strong stimuli (often noxious) were required to produce alert E.C.G.s. With less extensive destruction, the pattern was identical during the early days, but as normal behavior and temperature control returned,

the E.C.G. returned toward preoperative levels ; alerting was more and more easily produced.

4. After massive unilateral lesions there was a change to slow frequencies in ipsilateral cortex, but with stimulation the cortical pattern tended to become bilaterally symmetrical as alerting occurred. When the remaining half of the hypothalamus was destroyed, greater symmetry appeared ; the effects resembled those following one-stage destruction.

5. It may be concluded that destruction of the hypothalamus produced a cortical potential pattern of the sleep type, which could, however, be blocked and changed to the alert type by stimuli of sufficient intensity. This supports the hypothesis that the hypothalamus normally exerts an alerting effect upon the cortex, which is involved in maintaining resting wakefulness. This is but one component, however, because strong alerting stimuli can break through the sleep of cats lacking a hypothalamus, indicating that accessory components may still serve to support wakefulness in the absence of the hypothalamo-cortical facilitatory mechanisms.
(Authors' abstr.)

The Effect of Benzedrine on the Post-electroshock E.E.G.

1. In 44 *Macacus rhesus* monkeys and in 15 humans, the observations of other investigators on immediate and prolonged E.E.G. effects of electroshock convulsions have been repeated and confirmed.

2. E.E.G. alterations during and after electroshock convulsions can be divided into five phases : 1. High amplitude fast waves appear during the tonic phase of the convulsion. 2. Fast and slow waves are mixed during the clonic phase of the convulsion. 3. Marked low amplitude, or flattening, characterizes the electroencephalogram during the immediate post-convulsive period. 4. High amplitude 1-3 per second waves appear most prominently in the frontal leads and persist during the period of post-convulsive stupor.

5. Six per second and then normal frequencies are mixed with the 1-3 per second waves, and there is a gradual shift to normal.

3. The fourth phase, that of extreme post-convulsive slowing, was eliminated in 11 of 19 trials in monkeys when Benzedrine 1-3 mg./kilo was given subcutaneously 10-15 minutes before the shock, and the animals appeared more alert. In humans, Benzedrine was not adequately tested for its effect on immediate post-convulsive slowing but, as in the monkeys, it did not affect the fifth phase. It did not alter post-convulsive confusion.

4. The Benzedrine effect was not reproduced by any of the other drugs tested. These included the dextro- and laevorotatory forms of Benzedrine. Both the vasomotor and central nervous system stimulating, effects of racemic Benzedrine appeared to play a role in the mechanism of its action.

5. The persistence of post-convulsive slowing was also affected by the number of shocks and by the position of the shocking electrodes ; it was increased with increasing numbers of shocks and by transfrontal electroshock. Electroencephalographic slowing was less persistent after transoccipital than after transfrontal shocks, and the site of maximum slowing tended to be posterior with posteriorly delivered shocks.
(Authors' abstr.)

Comparative Effectiveness of Sleep and Metrazol-activated Electroencephalography.

In 210 patients with various manifestations of epilepsy, 37 per cent. showed seizure discharges in the electroencephalograms recorded while awake. The use of sleep E.E.G. increased the incidence of such discharges to 47 per cent. In the group of 102 patients who had normal or borderline electroencephalograms while awake, 15 (14.7 per cent.) demonstrated seizure discharges during sleep.

Sleep recording contributed most information in the group with psychomotor seizures, and was especially valuable in demonstrating anterior temporal spike foci in these patients.

In 138 of the patients, the results of sleep and Metrazol-activated E.E.G. were compared. There was a 33 per cent. incidence of seizure discharges while awake. With sleep recording, the incidence was increased to 40 per cent. and with Metrazol to 62 per cent. In almost all cases, seizure discharges recorded during sleep were also observed during Metrazol activation.

Metrazol induced seizure discharges in the electroencephalograms of 35 (45 per cent.) of the 77 patients with normal or borderline records while awake. Sleep was successful in only 10 patients (13 per cent.) of this group.

Metrazol was more effective than sleep in all clinical groups except for the group with psychomotor epilepsy. The focal character of the seizure discharges in the patients with psychomotor epilepsy was best demonstrated during the sleeping state.

(Authors' abstr.)

ENCEPHALE (ATHENS).

VOL. I.

DECEMBER, 1950.

Organic and Functional in Neuropsychiatry. <i>Guiraud, P.</i>	214
Psychosurgical Methods for Psychiatric Disorders and Intractable Pain. <i>Kalinowsky, L. B.</i>	225
A Case of Multiple Sclerosis of Early Onset. <i>Kourétas, D., and Caloutsis, A.</i>	235

EVOL. PSYCHIAT.

VOL. XX.

JANUARY-MARCH, 1951.

Ethics and Psychology of a Group of Maladjusted Adolescents. <i>Amado, G.</i>	3
Repression. <i>Aubin, H.</i>	31
Psychological Aspects of Old-Age. <i>Minkowski, E.</i>	49
Art and Insanity. <i>Zeldenrust, K.</i>	73

FOL. PSYCHIAT. NEUR. NEUROCHIR. NEERL.

VOL. LIII.

1950.

Neuropsychiatric Complications with "Italian Influenza." <i>Bartstra, H. K. G., and Pesman, J.</i>	771
A Special Case of Hydromyelia. <i>Biamond, A.</i>	783
Prolapsed Intervertebral Disc. <i>Bos, T. H.</i>	789
Migraine with Paralyzes. <i>Hardon, J.</i>	802
On the Treatment of Psychopaths. <i>Heringa, S.</i>	806
Some Remarks Concerning the Free Will. <i>Hirschfeld, H.</i>	810
Modern Psychiatry and Psychosomatic Medicine. <i>van der Horst, L.</i>	814
The Psychiatric Ward as a Subdivision of a General Hospital. <i>Koek, H. C.</i>	822
Personality in Mental Illness. <i>Kraus, G.</i>	828
Problems in the Field of Neurosis and Psychotherapy. <i>Rümke, H. C.</i>	839
Short-lived Alterations in the Personality Make-up Following E.C.T. <i>Terpstra, J. J.</i>	858
The Left Field of Psychiatry. <i>Timmer, A. P.</i>	862
Some Problems Related to So-called Religious Paranoia. <i>Tolsina, F. J.</i>	865
The Pathogenesis of Epilepsy from a Clinical Point of View. <i>van Valkenberg, C. T.</i>	879
Epilepsy Associated with Cerebral Tumours. <i>Weersma, M.</i>	889
Authenticity and Advantages of Age Regression in Hypnotherapy. <i>Zeckel, A.</i>	906
Observations on Thallium Intoxication. <i>Zuithoff, D.</i>	915
Brain Abscess. <i>van der Zwan, A.</i>	925

VOL. LIV.

FEBRUARY, 1951.

Notes on Diabetes Insipidus in Connection with Two Cases of Hypothalamic Tumour. <i>Scholten, J. M.</i>	6
The Significance of the Collective Guilt Complex in Antisemitic Aggression. <i>Stokvis, B.</i>	33
Two Cases of Porencephaly. <i>Moffie, D., and Bode, C.</i>	40
Some Experiences with $\text{CCl}_3\text{CH}(\text{OH}_2)$ in Psychiatric Practice. <i>Lietaert, P. M.</i>	46
Theoretical Remarks on Movement Therapy. <i>Dijkhuis, J. J.</i>	49

APRIL.

Exaggeration, Mythomania and Simulation in the Light of the Rorschach Test. <i>Schachter, M.</i>	95
Problems of Aphasia. <i>Prick, J. J. G., and Calon, P. J. A.</i>	112

The Semantic Necessity of a New Psychosomatic Terminology.	<i>Stokvis, B.</i>	130
A Study on the Neurinoma.	<i>Hartog, B. J. C. den</i>	132
Anencephaly and Rachischisis.	<i>van der Zwan, A.</i>	147

GENET. PSYCHOL. MONOGR.

VOL. XLIII.		FEBRUARY, 1951.
A Study of Copying Ability in Children.	<i>Townsend, E. A.</i>	3
Prestige Motivation of Gifted Children.	<i>Ansabel, D. P.</i>	53

GIORN. PSICHIAT. NEUROPAT.

VOL. LXXIX.		1951.
Psychosis from Anti-semitic Hatred in Aliens.	<i>Baruk, H.</i>	5
Neuromesodermosis.	<i>Bolsi, D.</i>	15
Clinical Experience with Succinic Dinitrile.	<i>Tanfani, L.</i>	23
Radiological Study of the Basal Cistern in Tubercular Meningitis.	<i>Tobi, A.</i>	39
Statistical Study on Movement of the Mentally Ill.	<i>Castelletti, V.</i>	55

IND. J. NEUR. PSYCHIAT.

VOL. II.		1950.
Transorbital Leucotomy in India with Certain Modifications.	<i>Davis, R. B.</i>	109
Refusal of Food in Mental Patients.	<i>Nandi, D. N.</i>	125

INTERNAT. J. PSYCHOANAL.

VOL. XXXII.		1951.
Psychoanalysis and the Problem of Asthetic Value.	<i>Read, H.</i>	73
The Pan-headed Moses.	<i>Rosenfeld, E. M.</i>	83
Postscript to my Paper on the Moses of Michelangelo.	<i>Freud, S.</i>	94
An Unknown Statuette of Moses.	<i>Servadio, E.</i>	95
A Dream, A Vision and a Poem.	<i>Beres, D.</i>	97
A Psychological Study of Murder.	<i>Bromberg, W.</i>	117
Sexual Symbolism in Industry.	<i>Thomas, M.</i>	128

J. BRAZ. PSIQUIAT.

VOL. I.		1950.
Investigation of the Metabolism of Sugar Associated with Protein and Lipides during Insulin Coma.	<i>Medeiros, M. de</i>	179
New Researches on Malariotherapy with "Plasmodium Falciparum."	<i>Garcia, J. A., et al.</i>	200
Investigation of 17-Ketosteroids in Clinical Psychiatry.	<i>Ferreira, A. C.</i>	212

J. CLIN. PSYCHOL.

VOL. VII.		APRIL, 1951.
A Scale of Neuroticism.	<i>Winne, J. F.</i>	117
Brief Tests of Intelligence in the Psychiatric Clinic.	<i>Knott, J. R., et al.</i>	123
The Immediate Test.	<i>Corsini, R.</i>	127
The Hillside Short Form of the Wechsler-Bellevue.	<i>Gurvitz, M. S.</i>	131
Wechsler-Bellevue Subtest Scatter in the Affective Disorders.	<i>Waldfogel, S., and Guy, W.</i>	135
A Test-retest Evaluation of the Wechsler Forms I and II with Mental Defectives.	<i>Hays, W., and Schneider, B.</i>	140
A Study of the Differential Responses on the Vocabulary Subtest of the Wechsler-Bellevue Intelligence Scale.	<i>Stacey, C. L., and Portnoy, B.</i>	144
The Effect of Laterality Localization of Focal Brain Lesions on the Wechsler-Bellevue Subtests.	<i>Anderson, A. L.</i>	149
The Stereognostic Capacity of Brain-injured as Compared with Familial Mental Defectives.	<i>Sloan, W., and Bensberg, G. J.</i>	154

A Comparison of Recall and Recognition Types of Measurement on Verbal Items, etc. <i>Glik, E. E.</i>	157
A Comparison of the Stimulus Value of Szondi's Pictures with those of Normal Americans. <i>Guertin, W. H.</i>	163
The Letter Series as a Projective Technique. <i>Wiltshire, H. M.</i>	167
Parent-Child Similarities in Personality Disturbances. <i>Philipps, E. L.</i>	188

J. COMP. NEUR.

VOL. XCIV. FEBRUARY, 1951.

The Mammalian Midbrain and Isthmus Regions. II. <i>Crosby, E. C., and Woodburne, R. T.</i>	I
Quantitative Effects of Radon Implanted in the Medulla Oblongata. <i>Borison, H. L., and Wang, S. C.</i>	33
The Nervous System of the Earthworm <i>Megascolex</i> . <i>Adey, W. R.</i>	57
An Experimental Approach to the Problem of Pallial Differentiation. <i>Piatt, J.</i>	105
The Distribution and Temporal Course of Fiber Degeneration after Experimental Lesions in the Rat Brain. <i>Combs, C. M.</i>	123

APRIL.

Organization of the Fasciculus Solitarius in Man. <i>Schwartz, H. G., et al.</i>	221
The Organization of the Nervous System of <i>Ariolimax columbianus</i> . <i>Turner, R. S., and Nevius, D. B.</i>	239
Biochemical and Physiological Differentiation during Morphogenesis. XIII. <i>Kimel, V. M., and Kavalier, F.</i>	257
A Cytological Study of Transneuronal Atrophy in the Cat and Rabbit. <i>Cook, W. H., et al.</i>	267
The Motor Cell Columns of the Lumbo-sacral Spinal Cords of the Cat. <i>Romanes, G. J.</i>	313

J. COMP. PHYSIOL. PSYCHOL.

VOL. XLIV. APRIL, 1951.

Figural Preferences in the Drawings of a Chimpanzee. <i>Schiller, P. H.</i>	101
The Influence of the Genotype on the Retention of a Maze Habit in the Rat Following E.C.T. <i>Bendig, A. W., and Braun, H. W.</i>	112
The Effect of Glutamic Acid Supplementation on Problem Solving of the Instrumental Conditioning Type. <i>Zabarenko, L. M., et al.</i>	126
Some Effects of l(+) Glutamic Acid on Sound-induced Seizures in Mice. <i>Ginsburg, B., et al.</i>	134
The Effect of Partial Reinforcement on Behavior During Satiation. <i>Linton, H. B., and Miller, N. E.</i>	142
Intraproblem-interproblem Relationships in Learning by Monkeys. <i>Meyer, D. R.</i>	162
A Further Demonstration of the Effects of Electro-convulsive Shock on a Conditioned Emotional Response. <i>Brady, J. V., and Hunt, H. F.</i>	204

J. EX. PSYCHOL.

VOL. XLI. JANUARY, 1951.

The Effects of an Interfering Task on the Learning of a Complex Motor Skill. <i>Baker, K. E., et al.</i>	I
Food Deprivation and Discrimination Reversal Learning in Monkeys. <i>Meyer, D. R.</i>	10
Effect of Distribution of Practice on Rotary Pursuit "Hits." <i>Ammons, R. B.</i>	17
Perceptual versus Analytical Responses to the Number Concept of a Weigl-type Card Sorting Test. <i>Grant, D. A.</i>	23
Transposition in Children as a Function of Age. <i>Alberts, E., and Ehrenfreund, D.</i>	30
An Experimental Investigation of Reactive Inhibition and Conditioned Inhibition. <i>Montgomery, K. C.</i>	39

FEBRUARY.

The Relationship of Anxiety to the Conditioned Eyelid Response. <i>Taylor, J. A.</i>	81
New Gradients of Error Reinforcement in Multiple-Choice Human Learning. <i>Marx, M. H., and Bunch, M. E.</i>	93
The Effect of Reinforcement on the Alternation of Guesses. <i>Bendig, A. W.</i>	105
The Perception of the Vertical. <i>V. Mann, C. W., and Passey, G. E.</i>	108
Post-rotational Perception of Apparent Bodily Rotation. <i>Mann, C. W., et al.</i>	114
The Negative Effect of Previous Experience on Productive Thinking. <i>Birch, H. G., and Rabinowitz, H. S.</i>	121
Pursuit Learning as Affected by Size of Target and Speed of Rotation. <i>Helmick, J. S.</i>	126

J. GENET. PSYCHOL.

VOL. LXXVIII.

MARCH, 1951.

Adaptive Conditioning. <i>Caldwell, W. E.</i>	3
College Grades and the Group Rorschach. <i>Thompson, G. M.</i>	39
Occupational Aptitudes of Delinquents. <i>Holmes, J. A.</i>	47
A Study in the Learning of Two Types of Serial Order Material Presented Simultaneously. <i>Herman, D. T., and Broussard, I. G.</i>	55

J. NEUROPATH. EX. NEUR.

VOL. X.

APRIL, 1951.

Dystrophia Myotonica and Myotonia Congenita. <i>Wohlfart, G.</i>	109
Hallervorden-Spatz Disease and Dystonia. <i>Netsky, M. G., et al.</i>	125
Experimental Congenital Toxoplasmosis. <i>V. Cowen, D., and Wolf, A.</i>	142
Paralysis Caused by Penicillin Injection. <i>Tarlov, I. M., et al.</i>	158
*Comparative Morphologic and Histometabolic Studies of Nerve Cells in Brain Biopsies and Topectomies. <i>Roizin, L.</i>	177
*The Effect of Morphine on Cats with Hypothalamic Lesions. <i>McCrum, W. R., and Ingram, W. R.</i>	190
Extraventricular and Intra-cerebellar Papilloma of the Choroid Plexus. <i>Greene, R. C.</i>	204
Torula Meningoencephalitis. <i>Globus, J. H., et al.</i>	208

Comparative Morphologic and Histometabolic Studies of Nerve Cells in Brain Biopsies and Topectomies.

From the foregoing studies it seems that :

1. A morphologic variability of the medium and large pyramidal cells in the brain of selected biopsies and topectomies is associated with marked variability in the activity of the indophenol oxidase (cytochrome-C oxidase), peroxidases and the acid phosphatases. Generally, the oxidase and peroxidase reactions follow very closely the microscopic features and the distribution of Nissl bodies. The acid phosphatases appear frequently more concentrated in the intracellular areas of more pronounced chromatolysis. Irregularity in reaction and distribution of acid phosphatases are common in various degenerative changes of the nerve cells. Decrease and rarefaction of the granular material of the reacting substrate are encountered in the pycnotic and ischemic type of neuronal changes.

2. There is an apparent close similarity between peroxidase activity of the protoplasmatic components of the studied neurons and some components of the fluid and corpusculated blood elements.

3. There are concomitant variations in the morphology and enzyme activity of the neurons, and in the glial elements involved in the process of pseudoneuronophagia and neuronophagia.

Whether these variations of the correlated morphologic and histometabolic findings of the investigated cortical nerve cells are due to changes in their functional activity or whether they are due to some other as yet undetermined conditions, is left open for further investigations.

(Author's abstr.)

The Effect of Morphine on Cats with Hypothalamic Lesions.

A group of normal cats was given injections of morphine sulfate ranging from 5 mg. to 35 mg. per kg. of body weight, and in every case there was a marked rise in rectal temperature and an increased amount of body activity, which if permitted reached a convulsive level.

In order to locate possible sites of action of morphine in the central nervous system, electrolytic lesions were placed stereotactically in the caudal hypothalamus and upper tegmentum in ten cats. Four of the animals in which the lesions were presumably not in critical areas, showed a nearly normal postoperative behavior, and their reactions to morphine were those seen characteristically in normal animals. Six animals showed loss of temperature control and chronic somnolence post-operatively, and in these animals the response to morphine injection was greatly altered; hyperthermia and hyperactivity did not appear.

A cataleptoid state was present in some of the operated animals of both groups and appeared independent of other behavior patterns. This condition did not seem to affect the animal's reaction to morphine. (Authors' abstr.)

J. NERV. MENT. DIS.

VOL. CXIII.	MARCH, 1951.
Some General and Neurologic Aspects of Atomic Medicine. <i>Arbuse, D. I.</i>	189
Accident Proneness in Multiple Sclerosis. <i>Bennett, A. E.</i>	198
Modification of the Electroshock Convulsions by Means of Curare, Intravenous Barbiturate and an Airway. <i>Brody, M.</i>	211
Facialgia. <i>Raney, A. A., et al.</i>	223
Treatment of Schizophrenia. <i>Gottlieb, J. S., and Huston, P. E.</i>	237
Further Observations on Sixty-two Lobotomized Psychotic Male Veterans at the Veterans' Hospital. <i>Drubin, L.</i>	247

APRIL.

A Review of Electrocardiographic Changes in Emotional States. <i>Blom, G. E.</i>	283
Physiologic Observations on Spinal Cord Function in Paraplegics. <i>Kuhn, R. A.</i>	301
*Migraine as a Form of Neurasthenia. I. <i>Gans, M.</i>	315
*Sexual Behaviour after Lobotomy. <i>Levine, J., and Albert, H.</i>	332
Contested Wills. <i>Eliasberg, W. G.</i>	342

Migraine as a Form of Neurasthenia.

Upon comparison of the characteristics of neurasthenia and migraine the following similarities can be found:

1. On the one hand, an increased excitability of the nervous system in respect to external and internal stimuli, and, on the other, an abnormally rapid onset of exhaustion. Associated in some degree are the following characteristics:

2. The autonomic system is not autonomous; and
3. There is a considerable fluctuation in the organic functions, particularly in the brain and digestive tract.

This is associated with two further characteristic group syndromes which are:

(a) The typical psychic changes with tendency to states of depression; and

(b) the neurasthenic gastro-intestinal disturbances.

4. The onset of the attack commences with a morning disorder.

5. *Cyclus diae inversus.*

6. Sleep as a cause of this cycle and these functional disturbances.

In migraine all these symptoms of neurasthenia are supplemented by one additional symptom, the headache.

Hence migraine should be regarded as being a special form of neurasthenia plus headache. (Author's abstr.)

Sexual Behavior after Lobotomy.

A series of 40 patients was interviewed at intervals of six months to four years after lobotomy for the purpose of determining changes in sexual behavior. They were specifically questioned in regard to sex drive, inhibition, phantasies, type of

sexual activity, subjective response and moral and religious attitudes. An attempt was made to correlate these features with the patient's clinical condition and work adjustment.

As might be expected, evaluation was difficult because of unknown effects of long hospitalization and long duration of illness.

In 4 patients, the sexual behavior after operation was such as to involve them in social difficulties. One of the patients had been a sexual psychopath before the onset of her psychosis with a return to promiscuous behavior after operation. Two patients who remained psychotic after operation were in constant difficulty because of their unbridled sexual verbalizations. Only one patient became a social problem after operation who had not been one before operation. This is the only instance in which it can be conjectured that the operation produced characteristics similar to those found in psychopathic personalities.

Homosexuality did not arise anew after lobotomy in *any* of the authors' series. Two patients with troubling homosexual phantasies preoperatively were completely relieved of those phantasies postoperatively. A third patient retained his homosexual phantasies after operation with minimal guilt and no anxiety. He did not act out his homosexual phantasies.

Although there were many variations in form of sexual expression, the predominant prelobotomy mode of sexual activity was maintained after lobotomy. Of 14 patients who were heterosexual before operation, 10 continued after operation, 1 became auto-erotic, and 3 denied sexual indulgence altogether. Of 6 patients who were predominantly auto-erotic before operation, 4 continued autoeroticism, 1 of whom added heterosexual activity. Two of the 6 gave up auto-eroticism and confessed no sexual activity. Of 6 patients who practiced both auto-eroticism and heterosexuality before operation, 1 continued as before, 1 practiced only auto-eroticism, 3 became solely heterosexual and 1 denied sexual activity.

A decrease in feelings of guilt, modesty and anxiety in connection with sexual activity was a striking phenomenon. This was more apparent in terms of personal restraints such as shame and abashment than in social restraints.

On the basis of the subjective report of the phantasy life of the patients, one must assume that phantasies are impoverished after lobotomy. In 15 patients, phantasies became less frequent and less vivid. Twenty-three denied phantasies; and only 2 patients described them as being more vivid. Several patients reported dreams after operation. Two patients reported dreams with manifest sexual content.

The degree of pleasure derived from sexual practices was reported by 20 patients; 1 felt there was no change in his enjoyment of sex, 12 had less pleasure and 7 had more.

Patients who were apathetic, and lacking in spontaneity usually had decreased sexual interest. However, no clear-cut correlations could be made between sexual functioning, and independent appraisal made by another group of workers, of the work adjustment, community adjustment and over-all clinical picture after lobotomy.

In general, patients and relatives reported that preoperative moral, social and religious attitudes continued to operate after lobotomy, even though there was a reduction in guilt, modesty and embarrassment in association with sexual activity.

(Authors' abstr.)

MAY.

Observations on Homosexuality Among University Students.	Glover, B. H.	377
The Skin.	Zaidens, S. H.	388
Self-inflicted Dermatoses and Their Psychodynamics.	Zaidens, S. H.	395
Treating Migraine by "Sleep-Rationing."	Gans, M.	405
*Self-inflicted Prefrontal Lobotomy.	Colom, G. A., and Levine, M. H.	430
A Study of Unstable Personalities after Combat.	Klein, J. J.	437
Cerebral Blood-Flow and Metabolism in Psychoses of Senility.	Freyhan, F. A., et al.	449

Self-Inflicted Prefrontal Lobotomy. Report of a Case.

The personality change noted in this patient is similar to that in those having surgical lobotomies in that there was an increase of self-indulgence and egoism,

restriction of activity due to inertia, and loss of drive and spontaneity with a decrease in apprehension, worry, insomnia and nervous tension. However, the anorexia with the return of depression and suicidal thoughts (although diminished), and the inappropriate affect are symptoms not encountered in successful surgical leukotomy. The expression aphasia, persistence of incontinence and her marked concern and awareness of thinking disturbance are suggestive of brain damage of greater extent than a lesion entirely confined to the prefrontal area. However, Watts and Freeman state that if sufficient white matter is not cut, the worry, nervous tension and depression are not permanently relieved; and in many cases, repeated leukotomies were done to alleviate these symptoms. It is felt that although extensive brain damage occurred in this case, an insufficient amount of white matter was destroyed to produce a satisfactory result in combating her psychosis. In one of the cases, similar to the present case, reported by Ardenghi, a supplementary surgical procedure was done to obtain a more satisfactory leukotomy. (Authors' abstr.)

J. NEUROSURG.

VOL. VIII.

MARCH, 1951.

- *Focal Epilepsy of Psychomotor Type. *Green, J. R., et al.* 157
 Meniere's Disease and its Surgical Treatment. *Castellano, F.* 173
 Metastatic Hypernephroma of the Brain from a Neurosurgical Point of View. *Störtebecker, T. P.* 185
 *The Experimental Application of Ultrasonics to the Localisation of Brain Tumors. *French, L. A., et al.* 198
 Treatment of Obstructive Hydrocephalus by Puncture of the Lamina Terminalis and Floor of the Third Ventricle. *Scarff, J. E.* 204

MAY.

- Acute Subdural Haematoma. *Chambers, J. W.* 263
 Notes on the Collateral Cerebral Circulation as Demonstrated by Carotid Angiography. *Tørkildsen, A., and Koppang, K.* 269
 Tracer Studies with Radioactive Phosphorus on the Absorption of C.S.F. and the Problem of Hydrocephalus. *Adams, J. E.* 279
 Studies in Neurosurgical E.E.G. *Wyke, B. D.* 289
 The Catabolic Effect of Craniotomy and its Investigative Treatment with Testosterone Propionate. *Cooper, I. S., et al.* 295
 An Evaluation of the Technic and Results of the Radioactive Diiodo-fluorescein Test for the Localization of Intracranial Lesions. *Ashkenazy, M., et al.* 300

Focal Epilepsy of Psychomotor Type. A Preliminary Report of Observations on Effects of Surgical Therapy.

1. A preliminary report is made regarding focal epilepsy of psychomotor type with reference to the effects of extensive gyrectomies and anterior temporal lobectomies.
2. Clinical, electroencephalographic and electrocorticographic studies show close correlation, indicating localization in the anterior temporal areas.
3. Gross or microscopic pathology was found in association with the electrographic disturbances in the anterior portion of the affected temporal lobe in 14 of the 23 patients. Tissue was not removed in 1 case. In general, these patients were benefited more by surgery than those in whom no pathology was found.
4. In selected cases of psychomotor epilepsy, temporal lobectomy, anterior to the acoustic receptive cortex, appears to be more effective than lobotomy or gyrectomy.
5. The neurologic deficits following anterior temporal lobectomy in this series are described.
6. Of 23 patients, 12 have had no psychomotor seizures postoperatively.
7. The effects of anterior temporal lobectomy on seizures, E.E.G. and mental status are reported. Clinical elements that appear to be associated with favorable and unfavorable results are discussed.
8. Whereas many years must elapse prior to formulation of definite conclusions, it appears that radical excision offers hope for selected patients who have definite

clinical and electrographic localisation and whose attacks are not controlled by medications. (Authors' abstr.)

The Experimental Application of Ultrasonics to the Localization of Brain Tumors. Preliminary Report.

1. Pulsed ultrasonic vibrations have been sent through normal and neoplastic cerebral tissues.
 2. The texture of the neoplastic cerebral tissues is such that the ultrasonic response is approximately twice that of normal cerebral tissue.
 3. Subcortical cerebral neoplasms have been located in post-mortem material by this method of investigation.
 4. Pulsed ultrasonic vibrations of this frequency did not produce demonstrable damage in the cerebral hemispheres of experimental animals.
- (Authors' abstr.)

J. NEUR. NEUROSURG. PSYCHIAT.

VOL. XIV.

FEBRUARY, 1951.

The Projection of the Olfactory Epithelium on the Olfactory Bulb in the Rabbit. <i>le Gros Clark, W. E.</i>	I
Observations on the Passage of Weed's Prussian Blue Mixture along the Axis Cylinders and Inter-fibre Fluid of Nerves. <i>Field, E. J.</i>	11
A Method of Measuring Reflex Time Applied in Sciatica and Other Conditions due to Nerve-Root Compression. <i>Malcolm, D. S.</i>	15
Arteriography and Carotid Artery Ligation in Intracranial Aneurysm and Vascular Malformation. <i>Wechsler, I. S., et al.</i>	25
Disability Caused by Brain Wounds. <i>Russell, W. R.</i>	35
The Visual Field Defects in Subacute Combined Degeneration of the Spinal Cord. <i>Benham, G. H. H.</i>	40
*An Investigation into the Effects of Glutamic Acid on Human Intelligence. <i>Milliken, J. R., and Slanden, J. L.</i>	47

An Investigation into the Effects of Glutamic Acid on Human Intelligence.

Two groups of mentally defective adults, one group of mentally defective children, and two groups of normal boys, were divided each into an experimental and a control section. Before and after treatment with glutamic acid or with an indifferent substance, each subject was given verbal, performance, and personality tests. After the second test administration each subject was transferred to the opposite section for a further period of treatment, at the end of which the tests were administered for a third time. The results of the cognitive tests provided no evidence in favour of the hypothesis that glutamic acid improves cognitive functioning, except in one group of normal boys, whose findings yielded slight but equivocal evidence in favour of the hypothesis. For the additional hypothesis, that scores on the personality tests would be improved, there was no evidence.

(Authors' abstr.)

J. NEUROPHYSIOL.

VOL. XIV.

MARCH, 1951.

Defects in Regulatory Mechanisms of Autonomic Function in Injuries to Spinal Cord. <i>Pollock, L. J., et al.</i>	85
*Changes in Excitability of Cerebral Cortex Following Single Electric Shock Applied to Cortical Surface. <i>Chang, H-T.</i>	95
Autogenetic Modulation of Excitability of Single Ventral Horn Cells. <i>Granit, R., and Ström, G.</i>	113
*Organization of the Diffuse Thalamic Projection System. <i>Starzl, T. E., and Magoun, H. W.</i>	133
Mechanism of Accommodation and Tone of Urinary Bladder. <i>Langley, L. L., and Whiteside, J. A.</i>	147
Relation of Temperature of Cerebral Cortex to Spreading Depression of Leão. <i>Marshall, W. H., et al.</i>	153
Strychnine Facilitation of Pressor Responses Evoked from Cerebral Cortex. <i>Hoff, E. C., et al.</i>	167

Changes in Excitability of Cerebral Cortex Following Single Electric Shock Applied to Cortical Surface.

The excitability of cortical neurons has been studied by means of local cortical potentials elicited either by a single electric shock applied to the cortical surface or by an afferent stimulation. Consequent to a single electric shock the cortical neurons underwent a period of refractoriness followed by a prolonged secondary depression. The degree and duration of the secondary depression varied with stimulus strength and the number of cortical neurons previously activated by the conditioning shock. The most severe depression was observed in the cortex locally treated with strychnine.

In the auditory cortex of the cat a single electric shock produced a periodic variation of cortical excitability with a frequency coincidental with that of the corticothalamic reverberating waves. The excitability was increased during the developing phase of the reverberating waves and decreased during the returning phase. The phase relations of the reverberating waves and the fluctuations of the excitability curve of cortex can be expressed mathematically.

It is suggested that the processes of the excitability change of cerebral cortex following a single shock are analogous in basic principles to the excitability change of spinal motoneurons or that of peripheral nerves. (Authors' abstr.)

Organization of the Diffuse Thalamic Projection System.

The diffuse thalamic projection system has been studied in the cat by evoking recruiting responses with thalamic stimulation and determining their distribution with recording electrodes moved systematically through the hemisphere.

The thalamic origins of this system include the centre median, intralaminar, anterior, ventralis anterior and anterior reticular nuclei. These components form a functionally interconnected unit, the excitation of any part of which sets the whole into activity. Radiations leave the thalamus principally from its rostral pole and to a lesser extent laterally, and project in a localized fashion to the caudate nucleus and to the associational cortex of the frontal, cingulate, orbital and suprasylvian portions of the hemisphere. The projection overlaps the motor region but avoids the sensory receiving areas.

The results suggest that the diffuse projection system is organized for mass thalamic influence upon associational cortex. (Authors' abstr.)

MAY.

- *Origin of Cerebellar Waves. *Brookhart, J. N., et al.* 181
- *Location of Receptors for Tonic Neck Reflexes. *McCouch, G. P., et al.* . . . 191
- Delayed Response Performance of Monkeys with Frontal Removals after
Excitant and Sedative Drugs. *Blum, J. S., et al.* 197
- *Cortical Projection of Vestibular and Facial Nerves in Cat. *Kempinsky,
W. H.* 203
- Unit Activity in Bulbar Respiratory Centre. *Dirkin, M. N. J., and Wold-
ring, S.* 211
- *Site and Extension of Bulbar Respiratory Centre. *Woldring, S., and
Dirkin, M. N. J.* 227
- *Characteristics of Responses from Electrogenic Tissue of *Electrophorus
electricus*. *Albe-Fessard, D., et al.* 243

Origin of Cerebellar Waves.

A study is reported of the relationships between cerebellar waves and cerebellar neuron spikes as recorded with microelectrodes thrust into the substance of the cerebellar cortex.

Considered from the anatomical point of view, evidence is presented indicating that both waves and spikes originate from structures in the Purkinje cell and/or granule cell layers of the cerebellar cortex.

Functionally, the selective susceptibility of the spike-forming mechanism to cerebellar ischemia indicates that the waves and spikes originate as the result of operation of functionally different mechanisms.

Arguments are presented in favor of the hypothesis that cerebellar waves may

be due to fluctuations of membrane potential not directly associated with conducted nerve impulses. (Authors' abstr.)

Location of Receptors for Tonic Neck Reflexes.

The location of the receptive field for the tonic neck reflexes has been studied in a series of labyrinthectomized, decerebrate cats. Only the responses to rotation of the neck have been studied in the entire series. An inadequate number of observations on the response to tilting the head suggest that the conclusions are also applicable to this reflex.

The response is retained unimpaired after section of all muscles connecting neck or trunk with the head, after bilateral section of muscular and cutaneous branches of the first three cervical nerves, and after resection and denervation of the muscles.

On the other hand, the response is abolished ipsilaterally by unilateral circumcission of the first three cervical roots at their exit from the ligaments and abolished in all four extremities by bilateral circumcission, although muscular and cutaneous nerves are left intact. In some animals decerebrate rigidity is lost with the neck reflexes, in others it remains unimpaired.

It is concluded that the reflex is ipsilateral and that the receptive field lies in the region of the upper joints of the neck, especially the atlanto-axial and atlanto-occipital joints. (Authors' abstr.)

Cortical Projection of Vestibular and Facial Nerves in Cat.

1. The cortical receiving area of the vestibular portion of the 8th nerve has been outlined by single shock stimulation of the "isolated" vestibular nerve in the cat.

2. The center of this vestibular sensory area lies in the anterior descending limb of the suprasylvian gyrus. Anteriorly it overlaps the posterior margin of the arm and face tactile receiving areas, and posteriorly it appears to overlap with the anterior margin of the auditory receiving area.

3. The ipsilateral and contralateral cortical projections are symmetrical in extent and location.

4. No cortical projection of possible afferent fibers of the facial nerve could be demonstrated, although one cannot exclude a projection from the nervus intermedius to this cortical region. (Authors' abstr.)

Site and Extension of Bulbar Respiratory Centre.

By means of localized recording of action potentials in respiratory rhythm and of localized stimulation of respiratory structures in the bulbar part of the medulla oblongata, two separate areas were located, a ventro-medial inspiratory part and a dorsolateral expiratory part. The inspiratory area is situated mainly in the reticular substance at the level of the entrance of the vagi; the expiratory area seems connected with the spinal trigeminal root laterally and has medially a course parallel to the solitary tract. (Authors' abstr.)

Characteristics of Responses from Electrogenic Tissue in Electrophorus Electricus.

1. Oscillographic records of discharges of the electric eel *Electrophorus electricus* are described, particularly as regards their temporal characteristics. Each wave of the normal repetitive discharge lasts 2-3 m./sec.

2. Simultaneous recording in two adjacent segments of the electric organ has sometimes revealed a central or precentral origin of the discharge, the wave front of which progresses in two opposite directions.

3. The speed of this progression, although lower than was previously supposed, is still too great to be accounted for by conduction in spinal cord or nerves: 250 m./sec. is a minimum value.

4. Small pieces of electric tissue respond to direct stimulation at threshold by giving brief waves circa 1 m./sec. in duration, which may be considered as the ultimate components of the total wave of discharge.

5. The stimulating current has its maximal effect when it is directed from the anterior to the posterior part inside the organ, i.e., when it is antidromic relative to the discharge.

6. Data on latencies, conduction velocities, spread of components and various types of responses have been picked up in different cases of indirect electric stimulation applied to skin, brain, spinal cord and electric nerves. The thresholds in the nervous structures were always found strikingly high.

7. The organization of the discharge involves an accelerated recruitment of active units in the electric organ. This acceleration seems to be the result of nervous actions and peripheral electric influences according to mechanisms which will have to be rendered more explicit by further studies. (Authors' abstr.)

J. PROJ. TECHNIQ.

VOL. XV.	MARCH, 1951.
The Stability of Certain Rorschach Variables under Conditions of Experimentally Induced Sets. I. <i>Gibby, R. G.</i>	3
The Use of Projective Techniques in the Study of Socio-psychological Aspects of Acculturation. <i>Hallowell, A. I.</i>	27
Rorschach Pattern of Normal Subjects of Graded Intelligence. <i>Neff, W. S., and Lidz, T.</i>	45
Developmental Aspects of Personality Structure in Normal Children. <i>Thetford, W. N., et al.</i>	58

J. PERSONAL.

VOL. XIX.	DECEMBER, 1950.
Cyclothymia and Schizothymia as a Dimension of Personality. I. <i>Eysenck, H. J.</i>	123
Measurement of the Individual's Reactions to Color in Ink Blots. <i>Süßola, E., et al.</i>	153
The Associative Valences of the Szondi Pictures. <i>Klopfer, W. G., and Borstelmann, L. J.</i>	172
Breast-feeding and Character Formation. II. <i>Goldman, F.</i>	189
The Hero and the Scapegoat in a Peasant Community. <i>Tumin, M. M.</i>	197
Cognitive Distortion and Ego-Involvement. <i>Levitt, E. E.</i>	212
Mental Age Changes in Experimental Regression. <i>Sarbin, T. R.</i>	221
The Standardization of a Psychodynamic Test. <i>Freeman, M. J.</i>	229

J. PSYCHOL.

VOL. XXXI.	APRIL, 1951.
The Order of Dominance Among Conceptual Capacities. <i>Dattman, P. E., and Israel, H. E.</i>	147
Comparison of Women Students in Occupational Therapy and in Nursing. <i>Schmidt, H. O.</i>	161
The Relative Influence of Error of Replicating Measurements and Individuals. <i>Jarrett, R. F., and Henry, F. M.</i>	175
The Effect of Thonzylamine HCl and Phenobarbital Sodium on Certain Psychological Functions. <i>Landis, C., and Zubin, J.</i>	181
The Effect of Differential Reinforcement on the Discrimination of Visual Number. <i>Minturn, A. L., and Reese, T. W.</i>	201
Suggestibility, Submission to Parents and Peers, etc. <i>Kates, S. L.</i>	233
Emotional-attitudinal Effects of an Intergroup Relations Workshop on its Members. <i>Levinson, D. J., and Schermerhorn, R. A.</i>	243
Value Judgments of Heights of Men by College Students. <i>Hinckley, E. D., and Rethlingshafer, D.</i>	257
War Themes in Children's Stories. <i>Rautman, A. L., and Brower, E.</i>	263
The Rate of Maturation and the Cephalization Coefficient. <i>Hofstaetter, P. R.</i>	271

J. SOC. PSYCHOL.

VOL. XXXIII.	FEBRUARY, 1951.
The Predictive Value of the M.M.P.I. with Student Nurses. <i>Weisgerber, C. A.</i>	3
A Critical Examination of Several Methods of Determining Levels of Social Status. <i>Thompson, G. G., et al.</i>	12

Some Determinants of Social Change. <i>Stewart, B.</i>	33
Measuring Socio-economic or Cultural Status. <i>Finch, F. H., and Hoehn, A. J.</i>	51
Some Aspects of Prejudice as Affected by Religion and Education. <i>Spoerl, D. T.</i>	69
Group Projection Sketches for the Study of Small Groups. <i>Henry, W. E., and Guetzkow, H.</i>	77
Religious Beliefs and Personality Characteristics of College Students. <i>Brown, D. G., and Lowe, W. L.</i>	103
Changes in Sexual Behavior and Attitudes Following Class Study of the Kinsey Report. <i>Giedt, F. H.</i>	131

J. SPEECH. HEAR. DIS.

VOL. XVI.

MARCH, 1951.

Cleft Palate Speech. <i>McDonald, E. T., and Baker, A. K.</i>	9
Group Speech Therapy for Motor Aphasia and Dysarthria. <i>Corbin, L. M.</i>	21
Type of Birth as Related to Stuttering. <i>Boland, J. L., jun.</i>	40
Artificial Stutter. <i>Lee, B. S.</i>	53
The Effect of Delayed Side-tone Upon Vocal Rate and Intensity. <i>Black, J. W.</i>	56
Some Sources of Literature on Speech Disorders. <i>Broadus, R. N.</i>	61

JUNE.

Muscle Training for Cerebral Palsied Speech Cases. <i>Westlake, H.</i>	103
An Exploratory Investigation of the Self-concept of Stutterers. <i>Fiedler, F. E., and Wepman, J. M.</i>	110
Cerebral Palsy Professional Training Activities in this Country. <i>Palmer, M. F.</i>	157
Infant Speech. <i>Irwin, O. C.</i>	159

NERV. CHILD.

VOL. IX.

JANUARY, 1951.

Problems of Speech Comprehension. <i>Froeschels, E., et al.</i>	2
---	---

OCCUP. THER. REHAB.

VOL. XXX.

APRIL, 1951.

Mobilization of Paraplegics. <i>Sanders, E. M.</i>	61
--	----

PISANI.

VOL. LXIV.

MAY-AUGUST, 1950.

The Test of Musical Memory of Drake. <i>Canziani, G., and Riccobono, L.</i>	5
A Contribution to the Study of Leber's Disease. <i>Smorto, G., and Sciorta, A.</i>	23
Retinal Arterial Pressure in Subjects after the Transorbital Leucotomy of Fiamberti. <i>Lodato, G.</i>	45
The Blood-marrow Picture in Schizophrenia. <i>Smorto, G., and Terrana, V.</i>	51
Perception and Language. <i>Migliorino, G.</i>	67
Bone and Articular Dystrophy in Encephalitic Parkinsonism. <i>Smorta, G., and Sciorta, A.</i>	79
Acetylcholine Shock in Narcosis. <i>La Loggia, M.</i>	105
Allergy and the Nervous System. <i>Santangelo, F.</i>	111

PROC. ROY. SOC. MED.

VOL. XLIV.

APRIL, 1951.

Discussion on Recent Advances in the E.E.G. Diagnosis of Epilepsy	315
Discussion on Parietal Lobe Syndromes	337

MAY.

*Studies in the Physiology of Awareness: Oximetric Evidence of the Role of Anoxia in Certain Psychiatric States. <i>Lovett Doust, J. W.</i>	347
---	-----

Studies in the Physiology of Awareness: Oximetric Evidence of the Role of Anoxia in Certain Psychiatric States.

What would appear to emerge, from the use of oximetric techniques, is that a common factor runs like a thread through the constantly fluctuating patterns of awareness seen in normal life; in the ever-present minor stresses which make up day-to-day existence; in the prototypes of major stress demands and the response of our homeostatic mechanisms to those demands; in the periodicities like sleep which impinge in phasic fashion on our individual pattern of consciousness. This common factor, or thread, is the organism's unique efforts to maintain a level of arterial blood oxygen saturation which represents for him an adequate balance of normal functioning potential and at the same time lies within the critical range of his brother's normal needs.

The author would also suggest that an individual's relative success in the maintenance of such a homeostatic equilibrium with respect to oxygen saturation levels is a function as much as anything of the emotional stability his personality represents—emotionally unstable individuals, such as those with psychoneurosis, being unable to maintain the same sort of relatively stable baseline in the face of life situational stress and responding with wide swings well outside the critical range of functional normality.

Finally the author has seen that schizophrenic individuals who, for one reason or another, have more or less permanently been unable to sustain blood-oxygen saturation levels consistent with the normal range of consciousness, represent a pattern of awareness very similar to that experienced during life at high altitudes or under any other condition of defective oxygen assimilation. Many such patients by voluntary empathic effort, can initially give the appearance of relatively normal awareness but the pall of anoxia soon falls on this, their arterial oxygen drops to the levels of sleep and their mental state conforms once more to Jung's remark about the schizophrenic—that he is a "dreamer in a world awake." The author has seen how the schizophrenic process may be reversed by insulin coma; such apparent reversal only occurs, in the author's experience, when the delayed effect of this coma is to raise the oxygen saturation levels.

Consciousness at one level or another is a dimension of life for the human personality and to the deviations from its thresholds can be attributed much of the phenomenology seen in psychiatry. If emotional tension be created by a conflict of desires denied expression, awareness falls away and a reality potential tends to be replaced by one of phantasy. At the same time that consciousness is dimmed, anoxia appears; conversely, when empathy and attention raise the thresholds of anoxia, conscious awareness increases and the oxygen saturation levels parallel its rise. Aside from all this is the significant fact that, with the induction of experimental anoxic anoxia and in step with the consequent fall in arterial oxygen saturation, there follows the sequence of diminishing awareness, uprising of emotional tension and instability, effective lability and that fragmented, chaotic, irresponsible, dream-like pattern of consciousness which is schizophreniform in quality when wakefulness is forced upon him who experiences it, yet whose *alter ego* is natural sleep.

(Author's abstr.)

PSYCHIAT.

VOL. XIV.

FEBRUARY, 1951.

Anticipation of Arousing Specific Neurotic Feelings in the Psychoanalyst.

Hill, L. B.	I
Psychotherapeutic Aspects of Authority. Worden, F. G.	9
Culture and Personality. Spiro, M. E.	19
Personality as a Factor in Administrative Decisions. Cohen, M. B., and R. A.	47
Observations Concerning the Clinical Method of Research, Ego-theory and Psychopathology. Money, J.	55
Some Current Concepts of Sexual Behavior. Masserman, J. H.	67
Psychiatry in Prison. Powelson, H., and Bendix, R.	73
The Inner Experience of Culture. Henry, J.	87

PSYCHIAT. QUART.

VOL. XXV.

JANUARY, 1951.

Treatment of the Psychoses. <i>Solomon, H. C.</i>	I
Impotence During E.C.T. <i>Michael, S. T.</i>	24
The Use of B.C.G. in Mental Institutions. <i>Stewart, H. C., et al.</i>	32
The Obstacle Motif as a Typical Dream Experience. <i>Barahal, B. S.</i> . . .	38
The B.E.S.T. in the Treatment and Control of Chronically Disturbed Mental Patients. <i>Brussel, J. A., and Schneider, J.</i>	55
Non-standard Method of E.C.T. <i>Koenig, J. H., and Feldman, H.</i>	65
Neurotic Crime <i>v.</i> Criminal Behavior. <i>Devereux, G.</i>	73
A Study of the Development and Course of Schizophrenia in Children. <i>Clardy, E. R.</i>	81
A Preliminary Report on Antabuse Therapy for Alcoholism. <i>Steckler, P. P., and Harris, L.</i>	91
Pain. <i>Matfus, J.</i>	97
A Study of Judgment in the Psychopathic Personality. <i>Simon, B., et al.</i> .	132

PSYCHOANAL. QUART.

VOL. XX.

JANUARY, 1951.

The Problem of Interpretation. <i>Loewenstein, R. M.</i>	I
Ego Psychology and Interpretation in Psychoanalytic Therapy. <i>Kris, E.</i> .	15
Technical Implications of Ego Psychology. <i>Hartmann, H.</i>	31
Early Development of the Ego. <i>Hendrick, I.</i>	44
Ego Psychology and Psychotherapy. <i>Gill, M. M.</i>	62
Character and Resistance. <i>Sterba, R.</i>	72
The Traumatic Effect of Surgical Operations in Childhood on the Integrative Functions of the Ego. <i>Miller, M. L.</i>	77
Two Observations on the Split in Object Choice. <i>Saul, L. J.</i>	93

PSYCHOL. REV.

VOL. LVIII.

JANUARY, 1951.

Homeostasis as a Unifying Concept in Personality Theory. <i>Stagner, R.</i> .	5
Theory of Double, Triple and Quadruple Repetition. <i>Woodbury, C. B.</i> .	18
The Concept of Energy Mobilization. <i>Duffy, E.</i>	30
Time and Aggression. <i>Frederickson, E.</i>	41
Illusion as a Problem in Systematic Psychology. <i>English, H. B.</i> . . .	52
An Ideal Equation of Forgetting Derived for Overlearning. <i>London, I. D.</i>	54
The Application of the Method of Paired Comparisons to the Study of Reaction Potential. <i>Burros, R. H.</i>	60

MARCH.

An Evaluation of Some Current Criticisms of Gestalt Psychological Work on Perception. <i>Luchins, A. S.</i>	69
The Effect of Personal Values on Perception. <i>Klein, G. S., et al.</i>	96
Autonomic Discrimination without Awareness. <i>Lazarus, R. S., and McCleary, R. A.</i>	113
An Examination of the Electrical Field Theory of Cerebral Integration. <i>Lashley, K. S., et al.</i>	123
Attention, Perception and Behavior Theory. <i>Berlyne, D. E.</i>	137

MAY.

The Current Status of Motivational Psychology. <i>Koch, S.</i>	147
The Brain Analogy. <i>Coburn, H. E.</i>	155
Two Kinds of Experiment Distinguished in Terms of Statistical Operations. <i>Marks, M. R.</i>	179
Response-Selection in Discriminative Learning. <i>Weise, P., and Bitterman, M. E.</i>	185
Conditioning and Conditionality. <i>Mowrer, O. H., and Lamoreaux, R. R.</i> .	196

Idiodynamics in Personality Theory with Special Reference to Projective Methods. <i>Rosenzweig, S.</i>	213
Some Theoretical Considerations of Learning. <i>Brogden, W. J.</i>	224
Some Methodological Comments Concerning Expectancy Theory. <i>Meehl, P. E., and MacCorquodale, K.</i>	230

PSYCHOSOM. MED.

VOL. XIII.

MARCH-APRIL, 1951.

Life Situations, Emotions and Nasal Disease. <i>Holmes, T. H., et al.</i> . . .	71
Evaluation of Psychotherapy. <i>Miles, H. H. W., et al.</i>	83
The Effects of Stress and the Results of Medication in Different Personalities with Parkinson's Disease. <i>Prichard, J. S., et al.</i>	106
Physiologic and Psychodynamic Mechanisms in Constipation and Diarrhoea. <i>Szasz, T. S.</i>	112
Personality Patterns in Patients with Malignant Tumors of the Breast and Cervix. <i>Tarlaw, M., and Smalheiser, I.</i>	117

QUART. J. EX. PSYCHOL.

VOL. III.

MAY, 1951.

Sensory Phenomena in Experimental Nerve Block. <i>Sinclair, D. C., and Himshaw, J. R.</i>	49
Variations in Reflex Blink-rate During Visual Motor Tasks. <i>Drew, G. C.</i> .	73
Difference Limina for Quality of Pure Tones. <i>Denes, P., and Cartier, F. A.</i>	89

Q. J. STUD. ALC.

VOL. XII.

MARCH, 1951.

The Effects of Alcohol on Conflict Behavior in the Albino Rat. <i>Conger, J. J.</i>	1
*Mechanism of the Action of Antabuse in Alcoholism. <i>Christensen, J. A.</i> .	30
*The Effect of Antabuse on the Metabolism of Ethyl Alcohol. <i>Newman, H. W., and Petzold, H. V.</i>	40
The Estimation of Methyl and Ethyl Alcohol from Current-Voltage Oxidation Curves. <i>MacNevin, W. M., and Sweet, T. R.</i>	46
The Role of Psychiatry in the Field of Alcoholism. <i>Tiebout, H. M.</i> . . .	52
New Attitudes Toward Alcoholism. <i>Osborn, L. A.</i>	58
Attic Temperance. <i>McKinlay, A. P.</i>	61
Group Therapy in Alcoholism. <i>McCarthy, R. G.</i>	103

Mechanism of the Action of Tetraethylthiuram Disulfide in Alcoholism. Iron as Antidote for the T.E.T.D.-Alcohol Reaction.

1. Manometric blood pressure studies in dogs confirmed the fact that an increased acetaldehyde level in blood produces effects similar to those of a sympathomimetic drug and parallels doses of l-epinephrine 1,000 times smaller. This sympathomimetic action of acetaldehyde was verified also by reversing it with an adrenergic blocking agent (C-7337) and by studies on Starling's heart-lung preparation in comparison with l-epinephrine.

2. The action of T.E.T.D. on acetaldehyde or l-epinephrine was to prolong the vasodilating phase, with a pronounced fall in blood pressure, an observation which explains the analogous clinical symptoms described in humans showing toxic reactions to T.E.T.D. and alcohol.

3. It is assumed that the action of T.E.T.D. is to alter the response of specific sympathomimetic receptor cells to the sympathomimetic mechanism of acetaldehyde or l-epinephrine.

4. Injection of iron salts intravenously tends immediately to reverse the phase of prolonged blood-pressure fall in spite of the fact that there is probably no change in the existing blood-acetaldehyde level. This may be explained by the fact that T.E.T.D. easily combines with heavy metals to form insoluble compounds, thus eliminating its action on the specific vasodilating receptor cells of the sympathetic system, without affecting the inhibitory action of T.E.T.D. on the oxidation of acetaldehyde.

(Author's abstr.)

The Effect of Tetraethylthiuram Disulfide on the Metabolism of Ethyl Alcohol.

The authors believe that two facts regarding the effect of T.E.T.D. on the metabolism of ethyl alcohol have been demonstrated by this research. First, T.E.T.D. certainly does not accelerate the rate of metabolism of alcohol; indeed, in some cases it may retard it. Second, T.E.T.D. slows the rate of metabolism of acetaldehyde, whether formed in the intermediary metabolism of ethyl alcohol or introduced directly into the body. This slowing does not occur in all animals.

Whether the slowing of acetaldehyde metabolism, with the consequent increase in blood acetaldehyde concentration, is or is not responsible for the clinical effect of T.E.T.D. is neither proved nor disproved by this work. This question can be decided only by research with human subjects. (Authors' abstr.)

RASS. STUDI PSICHIAT.

VOL. XL.

JANUARY-FEBRUARY, 1951.

Malarial Psychoses. Mario, C., and Giuseppe, S.	I
A Study of the Thymus in Schizophrenia. Amerigo, N.	27
Diuresis and Antidiuresis. Pegni, U., and Befani, A.	53
The So-called "Lipo-fibro-calcareous Myopathy." Ventura, E.	90
The "Aparnetic" Syndrome. Nistri, M.	111
A Contribution to the Heredity of Schizophrenia. Carlo, M.	118

MARCH-APRIL.

Alterations in Psychopathological Personality in Chronic Schizophrenics	
After Prefrontal Leucotomy. Giuseppe, G., and Giorgio, P.	205
Some Research into Postural Reflexes. Giorgio, L.	237
Magnesium Sulphate in Alcoholic Psychoses. Franco, R.	272
Acetylcholine Therapy. Sogliani, G.	291
Some Considerations on the Hyalinuridase in Insulin Coma. Giorgio, S.	299

REV. NEUROL.

VOL. LXXXIII.

NOVEMBER, 1950.

A Contribution to the Study of Intracranial Compression of the Optic Nerves, etc. Petit-Dutaillis, D., et al.	325
Spontaneous Intracerebral Hematomata. Rüshede, J.	342
A Study of a Series of Intracranial Aneurysms of the Internal Carotid. Laine and Soots	351

DECEMBER.

Bioelectric Potentials of the Cortex and of the Thalamus and their Alteration by Stimulation. Hess, R., jun., et al.	537
E.E.G. Semiology of Normal and Pathological Sleep. Passouant, P.	545
The Society for the Study of E.E.G. and Allied Sciences	560

VOL. LXXXIV.

JANUARY, 1951.

Diffuse Myelin Ganglioneuroma of the Cerebellar Cortex. Alajouanine, T., et al.	3
Spinal Amyotrophy of Infancy (Werdnig-Hoffman) as a Heredo-degeneration. Radermecker, J.	14

FEBRUARY.

Forms of Heredo-ataxia in the Child and the Adolescent, etc. van Bogaert, L.	121
Continuous Intracranial Manometry. Guillaume, J., and Janny, P.	131

RIV. PAT. NERV. MENT.

VOL. LXXII.

1951.

Streptomycin in Tuberculosis of the Neuraxis and of the Meninges. Luzzatto, A.	I
Results and Problems of Electromyography. Buchthal, F., and Pinelli, P.	156

- Treatment with Intraspinal Iodine of Buscaino in Acute Transverse Myelitis. *Luzzato, A.* 180
 The Variation in Cellular Size in the Red Nucleus of Some Mammals. *Macchi, G.* 197

RIV. PSICOL.

VOL. XLVI.

OCTOBER-DECEMBER, 1950.

- The Relation Between Thought and Language. *Migliorino, G.* 209
 Movement in the First Writing Experience of the Child. *Palazzo, A.* 215
 Research on the Act of Learning of the Rat in the Maze. *Majorana, A.* 233

U.S. ARM. FORCES M.J.

VOL. XI.

1951.

- Antabuse Therapy in the Army. *Brown, C. T., and Knoblock, E. C.* 191
 Psychologic Reactions to Winter Arctic Conditions. *Sacks, J. G.* 309
 Group Panic and Other Mass Disruptive Reactions. *Caldwell, J. M., et al.* 541

1. Pharmacology and Treatment.

Electroencephalographic Changes in Experimental Convulsions Caused by Divided Injections of Metrazole. *Muller, Heinz W. (Univ. Munster i W., Ger.). [Z. ges. exptl. Med., 116, 318-26 (1950).]*

In rabbits divided doses of 6 mg./kg. of metrazole (total dose 50 mg./kg.) caused a progressive increase of the amplitude of the basal rhythm. The frequency shifted to the upper limit of the normal range. After the crisis the waves returned to normal.
 J. H. WEISBURGER (Chem. Abstr.).

Narcotics and the Inorganic and Creatine Phosphates of Mammalian Brain. *Buchel, L., and McIlwain, H. (Maudsley Hosp., London). [Brit. J. Pharmacol., 5, 465-73 (1950); cf. C. A., 44, 10912i.]*

The brain of guinea pigs, narcotized by chloral (I), contains 6-10 mg. per cent. of (I) which is comparable to the concentration of (I) in the blood at the same time. (I) caused no changes in the inorganic phosphate (II) and creatine phosphates (III) *in vitro* in respiring slices of guinea pig brain when present in tissue concentrations of 10-20 mg. per cent. Tissue concentrations of (I) of 30-100 mg. per cent. which inhibited respiration, decreased (III) and increased (II). Concentrations of dial or neonal which inhibited respiration affected (II) and (III) similarly. The *in vitro* inhibition of respiration caused by narcotics had very different characteristics from that observed *in vivo* where (III) is raised and (II) is lowered. It is concluded that the biochemical changes found *in vivo* are a result of depressed functional activity caused by the narcotic.

RICHARD F. RILEY (Chem. Abstr.).

Effects of Various Drugs upon Cerebral Circulation and Metabolism in Man. *Shenkin, Henry A. (Univ. of Pennsylvania, Philadelphia). [J. Applied Physiol., 3, 465-7 (1951).]*

Caffeine (0.46 g. as the Na benzoate) increased the cerebrovascular resistance of patients recently operated upon for brain tumors, reduced the cerebral blood flow 15.6 per cent., but had little effect on the cerebral O consumption. Papaverine, 0.6 g. (as the HCl), given to patients prejudged to have slowed cerebral circulation, caused relaxation of the cerebral vasculature and reduced the mean arterial pressure and 0.7 mg. histamine base in 174 c.c. normal saline caused a decrease in the cerebrovascular resistance which correlated with the reduction of systemic blood pressure. Benzedrine given to 2 stuporous patients with slowed cerebral circulations caused no change in cerebral blood flow nor in cerebral O consumption.

THERESA MCKEE (Chem. Abstr.).

Permeability of Dura Mater to Epidural Procaine in Dogs. Rudin, Donald, O., Fremont-Smith, Kenneth, and Beecher, Henry K. (Harvard Med. School, Boston). [*J. Applied Physiol.*, **3**, 388-98 (1951).]

Epidural procaine anesthesia for the production of reversible, peripheral deafferentation of the spinal cord of dogs was used to study a part of the central nervous system temporarily devoid of sensory inflow from the periphery. From 2 to 3 per cent. procaine-HCl injected into the epidural space was found in the subarachnoid space (I) in concentrations of 0.3-0.8 mg./c.c. This occurred as the result of direct penetration of the nontraumatized dura and was not secondary to procaine in the blood stream. With anesthetic concentrations of epidural procaine (2-3 per cent.) the resulting amounts in (I) exerted an effect on the spinal cord.

THERESA MCKEE (Chem. Abstr.).

Effect of Certain Analgesic Drugs and Adrenal Cortical Hormones on the Brain of Normal and Hypophysectomized Rats as Measured by the Thiobarbituric Acid Reagent. Zauder, Howard L. (Duke Univ., Durham, N.C.). [*J. Pharmacol. Exptl. Therap.*, **101**, 40-6 (1951).]

Morphine (I), meperidine (II), methadone (III), and adrenaline (IV) when injected into rats daily for several days increased the ascorbic acid-catalyzed oxidation of linolenic acid in the brain homogenate as measured by the thiobarbituric acid (V) test procedure of Bernheim, *et al.* (*C. A.*, **42**, 5060d). Codeine, dionine and apomorphine caused a lesser increase. Cocaine, Na salicylate and pentobarbital had no effect. In hypophysectomized rats (I), (II), (III) and (IV) caused no change in (V) test values although they still produced analgesia. Injection of adrenal cortical extract increased the brain (V) test values in intact and hypophysectomized rats. (I), (II), (III) and (IV) caused no change in (V) test values although they still produced analgesia. Injection of adrenal cortical extract increased the brain (V) test values in intact and hypophysectomized rats. (I), (II) and (III) thus apparently cause a release of adrenocorticotrophic hormone from the hypophysis. It is suggested that there may be some parallelism between certain central effects produced by the adrenal cortical hormones, and the drugs which cause their release, and the reaction measured by the (V) test.

L. E. GILSON (Chem. Abstr.).

Blood Adrenaline in Electroshock. Kinzius, Hansjorg, and Hann, Joseph (Max-Planck Inst. Arbeitsphysiol., Dortmund, Ger.). [*Deut. Z. Nervenheilk*, **165**, 80-9 (1951); cf. *C. A.*, **44**, 4572e.].

Adrenaline (I) was determined in blood, taken by indwelling catheters from the vena cava, above and below the adrenal vein, before, during and after electric shock. In the first phase after the shock there was inhibition of (I) formation and increased consumption in the peripheral tissues. In the second phase there was excessive secretion of (I) by the adrenals and larger consumption. In the third phase the concentration of (I) returned toward normal, usually reached at 10-12 minutes after the shock.

WARREN M. SPERRY (Chem. Abstr.).

Alcohol-barbiturate Synergism. Ramsey, Helen J., Pinschmidt, N. W., and Haag, H. B. (Med. Coll. of Virginia, Richmond). [*Trans. Am. Therap. Soc.*, **46**, 54 (1946).]

In mice, 4 c.c. per kg. of EtOH increased the toxicity of seconal by almost 50 per cent. (on LD₅₀ values), and the toxicity of barbital and pentobarbital to about the same extent. In dogs, EtOH decreased the anesthetizing dose of pentothal, and anesthesia was markedly prolonged. In the rabbit, picrotoxin was very effective in counteracting pentobarbital but was less effective in the presence of EtOH. Applications to medical toxicology are discussed.

W. C. TOBIE (Chem. Abstr.).

Effects of Atropine on Brain Respiration. Cavanaugh, D. J. (Univ. of Chicago). [*Proc. Soc. Exptl. Biol. Med.*, **75**, 607-10 (1950).]

Atropine sulfate 0.001-0.01 M inhibited respiration of rat brain homogenates as much as 40 per cent. under optimal conditions. This effect was partially revers-

ible by acetylcholine under certain conditions. The degree of inhibition increased with the pH in the range pH 6-8. The ultraviolet absorption spectrum of atropine sulfate showed slight changes in the same pH range.

L. E. GILSON (Chem. Abstr.).

Sites and Mechanisms of Action of Morphine and Related Drugs in the Central Nervous System. Wikler, Abraham (U.S. Public Health Service Hosp., Lexington, Ky.). [*J. Pharmacol. Exptl. Therap.*, **100**, No. 4, Pt. 2; *Pharmacol. Revs.*, 435-506 (1950).]

L. E. GILSON (Chem. Abstr.).

2. Biochemistry, Physiology, etc.

Tannic Index of Serum Proteins for the Determination of Total Proteins in the Cerebrospinal Fluid. Ravier, H. (*Ann. biol. clin. (Paris)*, **8**, 604-6 (1950).)

To 0.5 c.c. of cerebrospinal fluid in a centrifuge tube, add 1.5 c.c. physiological saline and 0.5 c.c. of tannin in phenol (0.40 g. tannin and 0.10 g. phenol in 100 c.c. H₂O). Add a MgSO₄ crystal and stir the mixture. Heat until a precipitate begins to form. Centrifuge and decant the supernatant. Wash the precipitate with 4-5 c.c. saline, centrifuge, and combine the supernatant with the preceding one. Add to the pooled solutions 2 drops 10 per cent. NH₄ molybdate. Make up to 10-15 c.c. with H₂O. The resulting yellow color (representing excess tannin) is measured in a spectrophotometer using a blue filter. The results are referred to a standard curve, based on a mixture of serums of known protein concentration.

T. J. WINNICK (Chem. Abstr.).

Method for Application of the Abderhalden Reaction to the Cerebrospinal Fluid. Elsaesser, K. H. (Univ. Halle, Ger.). [*Allgem. Z. Psychiat.*, **124**, 228-35 (1949).]

The Abderhalden protective enzyme reaction is more easily applied to the cerebrospinal fluid (C.S.F.) than to urine: To 2 ml. portions of C.S.F. are added 0.5 ml. portions of suspensions of substrates prepared from different parts of the brain. The mixtures are incubated at 37° for 6 hours and filtered. To 0.5 ml. of the filtrate is added 0.1 ml. of 1 per cent. ninhydrin (I), the solution is heated at 82° for 6-9 minutes, and the color is read. The success of the method depends on the proper preparation of the substrate which must give no (I) reaction and be in a finely divided suspension.

WARREN M. SPERRY (Chem. Abstr.).

Results Obtained by Application of the Abderhalden Reaction to Cerebrospinal Fluid. Flügel, F. (Univ. Halle, Ger.). [*Allgem. Z. Psychiat.*, **124**, 266-78 (1949).]

The method of Elsaesser (*C. A.*, **45**, No. 3900f) was applied to over 2,000 samples of cerebrospinal fluid from patients with various diseases of the central nervous system. The reaction was positive in 41 per cent. of all cases and no correlation with any disease or with any part of the brain, used as substrate, was evident.

WARREN M. SPERRY (Chem. Abstr.).

The Electromotive Action of Acetylcholine at the Motor End-plate. Fatt, P. (Univ. Coll., London). [*J. Physiol. (London)*, **111**, 408-22 (1950).]

While testing the hypothesis that acetylcholine (AcCh) exerts a polarizing effect at the motor end-plates of muscle fibers by increasing the end-plate membrane selective permeability to Na ions, the effects of AcCh under decreased Na concentrations were studied in the skeletal muscle of the frog *Rana temporaria*. AcCh continued to produce a local depolarization at the end-plate of muscles bathed in Na-free solutions, despite loss in mechanical response. Na ions appear to augment the depolarizing effect of AcCh, even in concentrations below that needed for propagated impulses, but are not essential for this depolarizing effect. Increased AcCh concentration in Na-free solutions containing prostigmine bromine (as anticholinesterase), resulted in higher depolarizing effects during the first 10 seconds. The theoretical significance of AcCh and end-plate depolarization is discussed in terms of direct penetration of the end-plate membrane by AcCh cations.

MORRIS ROCKSTEIN (Chem. Abstr.).

Factors Affecting the Synthesis of Acetylcholine by Brain Slices. McLennan, Hugh, and Elliott, K. A. C. (McGill Univ., Montreal, Can.). [*Am. J. Physiol.*, **163**, 605-13 (1950).]

The acceleration of the synthesis of acetylcholine by rat brain slices by high K concentration was confirmed. Addition of acetylcholine to the medium does not depress, but sometimes increases the rate of synthesis. In the presence of high K⁺ concentration, lack of Ca⁺⁺ markedly inhibits acetylcholine synthesis. Maximum synthesis occurs at about 1.3 mM Ca⁺⁺, and further increase of Ca⁺⁺ concentration is inhibitory. Mg⁺⁺ has similar but much smaller effects. The CO₂-bicarbonate buffer system is required for maximal synthesis. Any deviation from normal plasma concentrations of CO₂, bicarbonate, or H⁺ depresses synthesis. Pyruvate, oxalacetate, and citrate strongly inhibit synthesis in a glucose-containing medium.

E. D. WALTER (Chem. Abstr.).

The Mechanism of Synthesis of Acetylcholine. II. The Synthesis of Citrate by Brain Enzymes. Persky, Harold, and Guzman Barron, E. S. (Univ. of Chicago). [*Biochem. et Biophys. Acta*, **5**, 66-73 (1950) (in English); cf. *C. A.* **41**, 2090f.]

Water soluble preparations from acetone-dried rabbit brain in the presence of citrate (I), yeast juice (II), choline, Mg, K, and adenosine triphosphate (A.T.P.) carry out the following two reactions: (1) (I) $\rightleftharpoons$ oxalacetate (III) + "active" acetate; (2) "active" acetate + choline $\rightleftharpoons$ acetylcholine (IV). (III) was identified and the reversibility of (1) was shown by (I) synthesis in the presence of enzyme (III), acetate (II), Mg, and A.T.P. Conclusion: citrogenase catalyzes (1); Mg is probably prosthetic group of the enzyme. NaF, necessary for (IV) synthesis, had no effect on (III) formation from (1). p-Chloromercuribenzoic acid and methylbis (2-chloroethyl)amine inhibit (IV) but not (III) formation. Rabbit brain preparations contain aconitase and phosphatase. Dog brain preparations contain acetylphosphate phosphatase and adenosinetriphosphatase.

J. R. PORTER (Chem. Abstr.).

Effect of Adrenocorticotrophic Hormone (A.C.T.H.), Cortisone and Desoxycorticosterone on Brain Excitability. Woodbury, Dixon M., Sayers, George, Marti, L. A., and Wilhelmsen, Paul C. (Univ. of Utah, Salt Lake City). [*Proc. Soc. Exptl. Biol. Med.*, **75**, 398-403 (1950); cf. *C. A.*, **43**, 7146a; **44**, 4989a.]

Desoxycorticosterone acetate (D.C.A.) decreases brain excitability in rats as shown by elevation of the electroshock seizure threshold. Cortisone has the opposite effect. A.C.T.H. alone, 1 mg. 3 times daily, first lowers then slightly raises the threshold. Both A.C.T.H. and cortisone antagonize the action of D.C.A.

L. E. GILSON (Chem. Abstr.).

A Cytoplasmic Constituent of Brain. Dixon, K. C., and Herbertson, B. M. (Univ. Cambridge, Engl.). [*J. Physiol. (London)*, **3**, 244-7 (1950).]

Cerebral, cerebellar and spinal cord tissue of freshly-killed rabbits fixed in 10 per cent. formal saline, and embedded in paraffin wax, revealed a substance in many neurone cell bodies which reacts vividly with periodic acid-leucofuchsin stain of McManus (*C. A.*, **42**, 6873i) without haemalum counterstaining. This chromogenic substance, removable by prolonged boiling in an ethanol-ether mixture, is possibly a glycolipide.

MORRIS ROCKSTEIN (Chem. Abstr.).

Effect of Intravenous Injections of Casein Hydrolyzate on Electrocardiogram of the Rabbit. King, R. B., Trufant, S. A., and Ross, C. A. (Washington Univ., St. Louis, Mo.). [*Proc. Soc. Exptl. Biol. Med.*, **75**, 565-7 (1950).]

An enzymic hydrolyzate of casein (intended for intravenous feeding) was found to contain an agent which produced significant changes in the electric activity of the rabbit brain. The agent appears to be a protein fragment which is adsorbed by Amberlite IR-4 and which yields large amounts of glutamic and aspartic acids when subjected to acid hydrolysis.

L. E. GILSON (Chem. Abstr.).

Modifications of the Electroencephalogram Caused by Tetraethylammonium Ion. Jimenez-Vargas, J., and Molins, M. (Facultad med., Barcelona, Spain). [Rev. espan. fisiol., **6**, 125-30 (1950).]

Following intracisternal injections of 0.1 per cent. solutions, it appeared that the brain was affected directly. Lower concentrations caused only slight changes in the graphs.

J. H. WEISBURGER (Chem. Abstr.).

Phenylpyruvic Oligophrenia in the Dark-skinned Person. Fernandes, J. Ferreira (Univ. Minas Gerais, Brazil). [Brasil-med. (Rio de Janeiro), **64**, 225- (1950).]

Urine from a negress gave a positive test for phenylpyruvic acid (dark-green color on addition of a few drops of 5 per cent. Fe Cl₃; the urine was at pH 4-6).

NELLIE M. PAYNE (Chem. Abstr.).

The Dehydrogenase Action in the Sliced Brain Tissue of the Rat. (I) Tadokora, Tetsutaro, and Saito, Tsuneyuki (Hokkaido Univ.). [J. Agr. Chem. Soc., Japan, **18**, 394-6 (1942).]

The nucleotide-type dehydrogenases acted similarly for mannose and glucosamine as the substrate, while the thiazole-type enzymes showed stronger action for mannose than for glucosamine (C. A., **41**, 3139c). The dehydrogenase of the brain of albino rat acted similarly for mannose and glucosamine, and for acetate and glycine; thus it was inferred to be of the nucleotide type. The action of this enzyme was strongest for citrate, medium for mannose, and weakest for mannuronic acid. As the activator, MgCl₂ was most effective, CaCl₂ less effective and AlCl₃ least effective.

(II) Tadokoro, Tetsutaro and Hashimoto, Jizo. Ibid., 1159-60.

Dehydrogenase action in the brain tissue of cod for citrate was accelerated by MgCl₂, and it was weaker for glucosamine than for mannose. The dehydrogenase action of the brain of the albino rats accustomed to lower temperature (-5 to -15°) was compared to that at room temperature (18-20°). The dehydrogenase action of the former for citrate was weaker than that of the latter. When mannose and glucosamine were the substrates, there was no difference in the dehydrogenase action of the brain at lower temperature, but the action of the brain treated at room temperature was greater for mannose than for glucosamine.

S. KAWAMURA (Chem. Abstr.).

Histochemical Studies of Phosphatases in the Nervous System of Thiamine-deficient Pigeons. Shimizu, Nobuo, Handa, Yoshitoshi, Handa, Jiro, and Kumamoto, Tetsuzo (Wakayama Med. Coll., Wakayama-shi, Japan). [Proc. Soc. Exptl. Biol. Med., **75**, 696-9 (1950).]

In thiamine deficiency the nerve cells shrink and acquire increased amounts of alkaline phosphatase, whereas the neuropil shows very little such increase. Acid phosphatase of the axis cylinders and cytoplasm of the nerve cells is diminished. After administration of thiamine to the deficient pigeons a considerable return toward normal is observed. Accompanying restoration of the acid phosphatase, a network similar to the pattern of neurokeratin appears in the myelin sheaths.

L. E. GILSON (Chem. Abstr.).

Shifts in Ammonia Content of the Epileptogenic Zone of the Brain. Budanova, A. M. [Doklady Akad. Nauk S.S.S.R., **75**, 875-6 (1950).]

Determination of NH₃ in frozen (liquid air) brain sections of rabbits and dogs shows an increase (200-300 per cent.) over unfrozen controls. Glutamine shows no significant rise. The sections frozen were those of cerebral cortex in the vicinity of the visual segment.

G. M. KOSOLAPOFF (Chem. Abstr.).

Acetal Phospholipides of Brain. I. Procedure for Isolation of Crystallized Acetal Phospholipide from Brain. Thannhauser, S. J., Boncoddio, Nicholas F., and Schmidt, Gerhard (Tufts Coll., Boston, Mass.). [*J. Biol. Chem.*, **188**, 417-21 (1951).]

Beef brain was dried with Me_2CO and extracted twice with EtOH , first at 37° , then at room temperature. The alcohol extracts were concentrated to dryness, the dried residue was extracted at room temperature with petroleum ether and the residue saponified with 5 volumes N NaOH at room temperature. The saponified emulsion was adjusted to pH 5 with AcOH , cooled and precipitated with 2 volumes Me_2CO . The precipitate was resaponified in the same way, the dried saponified material allowed to stand 2 days at room temperature in 10 volumes ether and centrifuged. The residue was washed with ether, the combined ether solutions were dried, and extracted, with 1:4 alcohol-ether 4 times for 16 hours at room temperature. The extracts were worked up by treatment with Pb subacetate , Amberline XE-58, and Amberlite XE-64. The crystal 1 no.

1, 43 (α) $\text{D}^{22} 6.25^\circ$ (c 4, 1:1 CHCl_3 : MeOH).

II. The α -structure of Acetal Phospholipide of Brain. *Ibid.*, 423-30.

The fatty aldehydes in crystallized acetal α -phospholipide were converted into the corresponding fatty acids. Palmitic and stearic acids were identified by high-vacuum distillation of their Me esters . The compound does not contain unsaturated fatty aldehydes. There is more palmitic than stearic aldehyde.

FELIX SANUDERS (Chem. Abstr.).

Temperature and Convulsive Activity. Teschan, Paul, and Gellhorn, Ernst (Univ. of Minnesota, Minneapolis). *Arch. intern. pharmacodynamie*, **84**, 57-67 (1950).]

In experiments involving increased temperatures, convulsive potentials disappear before normal ones, and usually the spike potentials show progressive decrease in amplitude and frequency before they disappear. This is similar to the action of anoxia. More neurons are damaged by elevated temperature and topically induced convulsive activity than by heat on normal neurons. The frequency of convulsive discharges is much increased by repeated short periods of moderate heating.

M. L. C. BERNHEIM (Chem. Abstr.).

Life Situations, Emotions and the Excretion of Hippuric Acid in Anxiety States. Persky, Harold, Grinker, Roy R., Mirsky, I. Arthur, and Gamm, Stanford R. (Michael Reese Hosp., Chicago). [*Research Pubs.*, Assoc. Research Nervous Mental Disease, **29**, 297-306 (1950); cf. *C. A.*, **44**, 7445h.]

Review and discussion of authors' finding of a relation between excretion of hippuric acid, after administration of a test dose of Na benzoate , and emotional status.

W. M. S. (Chem. Abstr.).

Effect of Desoxycorticosterone Glucoside Upon Cerebral Blood Flow and Metabolism in Human Subjects. Bentinck, R. C., Gordan, Gilbert S., Adams, John E., Arnstein, L. S., and Leake, T. B. (Univ. of California, School of Med., San Francisco). [*J. Clin. Invest.*, **30**, 200-5 (1951).]

The effects of desoxycorticosterone glucoside (D.C.G.) upon the cerebral utilization of O_2 in human subjects was studied by the N_2O technique of Kety and Schmidt (*C. A.*, **40**, 7274⁸). Administration of D.C.G. produced a rise in the cerebral venous sugar concentration above the arterial level, indicating that it causes liberation of sugar from the brain. A small but significant increase in arterial glucose concentration also occurred; this suggests liberation of glucose from other sources, possibly the liver. Preliminary data suggest a difference in response to D.C.G. between individuals with normal and with deficient steroidal status. The mean arterial blood pressure, cardiac rate and rate of cerebral blood flow were not altered by D.C.G.

JOHN T. MEYERS (Chem. Abstr.).

Concentration and Distribution of Enkephalin in Brain of Humans and Animals. Raab, W., and Gigue, W. (Univ. of Vermont, Burlington). [Proc. Soc. Exptl. Biol. Med., **76**, 97-100 (1951).]

Colorimetric assay of a large number of human and animal brains for enkephalin (cf. C. A., **42**, 5981c) revealed a rather uniform pattern of intracerebral distribution in various species. No difference was found in the enkephalin content and distribution in brains of normal and psychotic humans. In animals, no major changes were observed under the influence of various hormones, adrenalectomy, hypophysectomy, convulsive drugs, electric stimulation of the brain, narcotics, conditions of stress, acetylcholine and N-free diet. Injection of dihydroxyphenylalanine was followed by a very marked temporary increase of the colorimetric readings, which suggests either a selective absorption of this substance by the brain or its conversion into enkephalin.

L. E. GILSON (Chem. Abstr.).

Distribution, Exchange and Migration of Phosphate Compounds in the Nervous System. Samuels, A. J., Boyarsky, L. L., Gerard, R. W., Libet, B., Brust, M., and Hearon, John Z. (Univ. of Chicago). [Am. J. Physiol., **164**, 1-15 (1951).]

The total P of guinea-pig brain, cord and nerve was determined in the fractions: acid-soluble P, phospholipide P, nucleoprotein P and phosphoprotein P. Following intraperitoneal P^{32} injection in single or daily (up to 14) doses, the specific activities of these fractions were determined at intervals up to 36 days after the final injection. Both diffusion of P from plasma to cells and uptake of inorganic P into organic combination are slow, even diffusion equilibrium requiring over 10 days. Malononitrile produced no change in amount or exchange rate of nucleoprotein or other fraction. Nerve section led to halving of phospholipide and doubling of nucleoprotein in nerve and to a sharp increase in exchange rates. Activities of cord were also increased. An anticipated peripheral flow of nucleoprotein along nerve fibers was not revealed by these experiments. Phosphoprotein, however, flowed at a rate of about 3 mm. a day. E. D. WALTER (Chem. Abstr.).

Effect of Generalized Convulsions on the Blood Histamine in Man. Gabraoui, B., and Abdel-Nabi, S. (Kasr-el-Aini Faculty Med., Cairo). [J. Roy. Egypt. Med. Assoc., **33**, 683-7 (1950).]

The plasma histamine level of patients undergoing electrically-induced convulsions was elevated for about 10 minutes after shock therapy.

ERICH HEFTMANN (Chem. Abstr.).

Mental Achievement of Congenitally Hypothyroid Children. Topper, Anne (Mt. Sinai Hosp., New York, N.Y.). [Am. J. Diseases Children, **81**, 233-49 (1951).]

In hypothyroidism there is an elevation of blood lipides, especially cholesterol. In young untreated cretins the total cholesterol was occasionally within normal limits. In treated children with hypothyroidism, after withdrawal of thyroid therapy, there was an increased serum cholesterol, which dropped after resumption of treatment with thyroid.

FELIX SAUNDERS (Chem. Abstr.).

Action of Malononitrile on the Nervous System. Reale, G. (Univ. Siena, Italy) and D'Argento, L. [Riv. patol. nervosa e mentale, **71**, 171-2 (1950).]

The findings of Hyden and Hartelius (C. A., **43**, 2330e) are not confirmed, especially with regard to the increase of nucleic acids. Malonitrile causes a toxic degenerative process in the nervous cells.

C. SCANDURA (Chem. Abstr.).

Decarboxylation of L-glutamic Acid by Brain. Wingo, Wm. J., and Awapara, Jorge (Univ. of Texas, Austin). [J. Biol. Chem., **187**, 267-71 (1950).]

Aqueous homogenates of rat brain contain a glutamic acid decarboxylase (I) as indicated manometrically by the production of CO_2 under anaerobic conditions, and the parallel increase in γ -amino-butyric acid shown by paper chromatography. (I) is active in homogenates for 2 hours and has a pH optimum of 6.8. It is inhibited by $10^{-4}M$ HCN hydroxylamine and semicarbazide, but not by octyl alcohol. Aspartic acid is not decarboxylated by (I). LEONARD J. COLE (Chem. Abstr.).

Hemolytic Acid Present in Horse Brain. I. Purification and Identification as cis-11-octadecenoic Acid. Morton, I. D., and Todd, A. R. (Univ. Cambridge, Engl.). [Biochem. J., **47**, 327-30 (1950).]

Free fatty acids of brain were isolated by EtOH extraction, the unsaturated fraction was obtained by precipitation with Pb salts, and was further fractionated by molecule distillation. The earlier fractions revealed most of the hemolytic activity. By further fractional crystallization at low temperature it was determined that the activity is practically entirely in the monoethylenic fraction. The hemolytic acid is identified as *cis*-11-octadecenoic acid not previously found in nature. The *cis*-11-octadecenoic acid was prepared synthetically and this also had the hemolytic properties of the natural acid.

II. Examination by the Insoluble Monolayer Technique. Goddard, E. D., and Alexander, A. E. *Ibid.*, 331-4.

The *cis*-configuration has been determined from the monolayer properties of the hemolytic fatty acid which, it is thought is a mixture of oleic and *cis*-11-octadecenoic acid.

Appendix. X-ray Examination of the Hemolytic Fatty Acid. Goddard, E. D., and Perutz, M. F. *Ibid.*, 334-5.

The x-ray photographs of built-up multilayers of hemolytic acid show the same layer spacing as those obtained with *cis*-11-octadecenoic acid.

S. MORGULIS (Chem. Abstr.).

Respiration and Phosphorylation in Preparations from Mammalian Brain. Case, E. M., and McIlwain, H. (Maudsley Hosp., London). [Biochem. J., **48**, 1-11 (1951).]

The main end products of *in vivo* (also of *in vitro*) metabolism of glucose in the brain are lactic acid and CO₂. In the brain, as elsewhere, oxidative phosphorylation forms a link between functional activity and the metabolism which supports such activity. These experiments aim at a determination of the balance between lactic acid and CO₂. By using dialyzed brain homogenates, conditions were determined for securing maximum P/O ratios (atoms inorganic P esterified/atoms O absorbed). Chloral lowered both with little change in the P/O ratio, but 2, 4-dinitrophenol (with little lowering, and even occasionally raising the respiration) greatly decreases the P/O ratio. Ethyl red is somewhat intermediate in its effect, and phenosafranine lowers P/O with variable action on the respiration. A system was also devised with diluted but undialyzed homogenates, and adenosine-5-phosphate as P acceptor (P/O ratios 0.6 to 1.8) in which 2, 4-dinitrophenol (also NaN₃) inhibited phosphorylation but had little action on respiration. (More or less similar effects were obtained also with phenosafranine, diazine green, neutral green and nicotine.)

S. MORGULIS (Chem. Abstr.).

The Aldehydes of the Acetal Phosphatides of the Brain. Leupold, Friedrich (Univ. Cologne, Ger.). [Z. Physiol. Chem., **285**, 182-200 (1950).]

The aldehydes of the acetal phospholipides of the brain were isolated as the dimethyl acetals in almost quantitative yield. The aldehydes were identified as *cis*-11-octadecenal and *cis*-9-octadecenal. Palmitaldehyde, stearaldehyde and myristaldehyde also occur in small amounts. FELIX SAUNDERS (Chem. Abstr.).

Identification of γ -aminobutyric Acid in Brain by the Isotope Derivative Method. Udenfriend, Sydney (Washington Univ., St. Louis, Mo.). [J. Biol. Chem., **187**, 65-9 (1950).]

The S³⁵-labelled pipsyl derivative of γ -aminobutyric acid (I) was prepared by treating 25 mg. of (I) with S³⁵-labelled p-iodophenylsulfonyl chloride (pipsyl chloride). An alcohol extract of mouse brain was treated with 10 mg. of iodine¹³¹-labelled pipsyl chloride. Paper chromatograms of each of the radioactive derivatives were developed with BuOH saturated with N NH₄ OH. The bands were located by radioautography, and each band was cut into several transverse segments. Each segment was eluted with water, transferred to a planchette, and dried. The

elutions need not be quantitative since calculations are based on the ratio of one isotope to the other. The samples are counted with and without a 0.003 inch Al absorber, which passes 40.2 per cent. of iodine¹³¹ radiation (F_s), and 0.08 per cent. of S³⁵ radiation (F_s). The proportion of each isotope in any sample is calculated from the simultaneous equations: $I^{131} + S^{35} = \text{counts without Al absorber}$ and $(F_1)I^{131} + (F_1)S^{35} = \text{counts with Al absorber}$, where I^{131} and S^{35} represents the number of counts due to the respective isotopes. A constant ratio throughout the band indicates homogeneity, and therefore identifies the iodine¹³¹-labelled compound. The brain extract yielded 3 bands on the chromatogram. The major band coincided with the synthetic sample of pipsyl- γ -aminobutyric acid, and the proportion of the 2 isotopes was constant throughout.

LEONARD J. COLE (Chem. Abstr.).

Nitrogen Metabolism in the Brain in Tetanus. Promyslov, M. Sh., and Pletsityi, D. F. (Inst. Gen. and Exptl. Pathol., Acad. Med. Sci. U.S.S.R., Moscow). [Doklady Akad. Nauk S.S.S.R., **70**, 271-3 (1950); cf. C. A., **43**, 7122b.

Injection of a fatal dose of tetanus toxin subcutaneously into a rabbit leg leads to no significant deviation from normal protein and lipide metabolism in the first 3-4 days, i.e., during symptoms of localized tetanus. In later stages, when tetanus is general, some increase of the rate of degradation of proteins and lipide substances is noticed (about 7-9 per cent. increase), which never reaches the levels shown in diphtheria intoxication. The increase of residual N in the brain is the result of the decline of phosphatides, cerebrosides and related N-containing lipide substances, with consequent decline of the ratio of lipide substances, with consequent decline of the ratio of lipide N to total N (to 10-10.7 per cent. compared to normal 12.2-12.6 per cent.). The essentially normal metabolism of brain protein may be due to the absence of an attack on the nerve cells, while the high rate of lipide degradation may be caused by enhanced activity of these cells.

Ibid., **74**, 1117-18 (1950).

Subcutaneous injection of tetanus toxin (between the ears) into rabbit in toxic dosage leads to lowering of protein and lipide in the brain, increase of rate of breakdown of proteins and lipides, lowering of lipide N (as a fraction of total N), especially noted at the height of the disease (5-7 days). On the whole, N-containing lipide breakdown increases more intensively than the same phenomenon occurring in general tetanus. No changes in the spinal cord are noted.

G. M. K. (Chem. Abstr.).

Silver Impregnation of Degenerating Axon Terminals in the Central Nervous System. Nauta, W. J. H., and Gyax, P. A. (Fed. Inst. Technol., Zurich, Switz.). [Stain Technol., **26**, 5-11 (1951).]

A new Ag technique especially suitable for demonstrating terminal degeneration within the central nervous system is described. Some of the chemical principles underlying the process of reductive liberation of metallic Ag from ammoniacal AgNO₃ solutions are discussed.

W. B. ESSELEN, JR. (Chem. Abstr.).

Synthesis of Silver Proteinates for Neurological Staining. Porter, Robert W., and Davenport, H. A. (Northwestern Univ. Med. School, Chicago). [Stain Technol., **26**, 1-4 (1951).]

Soluble derivatives of the AgNO₃ precipitates of various split protein products were prepared by dissolving the precipitate in a 30-40 per cent. aqueous solution of pharmaceutical peptone (Cudahy). The split proteins used included pepsin, trypsin and papain digests of albumin, globulin, gelatin, casein, protamine; tissue proteins from heart, liver and brain; an *Escherichia coli* digest of casein; and com. products, Amigen (Mead), casein hydrolyzate (Squibb) and pharmaceutical peptone (Cudahy). Only redissolved Ag precipitates of pharmaceutical peptone and bacterially digested casein stained axis cylinders selectively. The manner of degrading a protein prior to combining it with Ag was the most important factor in determining the subsequent staining reaction.

W. B. ESSELEN, JR. (Chem. Abstr.).

The Effect of Ammonium Chloride upon the Electroencephalographic Changes in Toxemia of Late Pregnancy. Preliminary Report. Parviainen, S., Temmes, Y., and Soiva, K. (Univ. Helsinki, Finland). [*J. Obstet. Gynaecol. Brit. Empire*, **57**, 780-5 (1950).]

In 6 toxemic patients the hyperventilation test, causing respiratory alkalosis, aggravated the electroencephalographic changes. In 2 cases with a severe sub-convulsive state the changes nearly disappeared during a treatment of a few days with NH_4Cl .
RACHEL BROWN (Chem. Abstr.).

Chemical Studies on Peripheral Nerve During Wallerian Degeneration. (II) Lipides After Nerve Crush (Axonotmesis). Burt, N. S., McNabb, A. R., and Rossiter, R. J. (Univ. Western Ontario, London, Can.). [*Biochem. J.*, **47**, 318-23 (1950); cf. *C. A.*, **44**, 3130a.]

Studies on the sciatic nerves of cats were made at intervals of 16-144 days following axonotmesis. The wet weight of the nerves increased following the operation reaching a maximum in 32 days. By the end of 144 days the weight returned to normal. The total lipid content decreased during the first 16 days then, after a stationary period, it increased gradually from the 48th day on but remained below that of the control even after 144 days. Neutral fat also decreased during the first 16 days but became normal again by the end of 48 days. The myelin lipides, including cerebrosides, free cholesterol, and sphingomyelin decreased for 32 days, then remained stationary for the next 64 days, when they began to rise gradually but even after 144 days were still only 44 per cent. of the concentration found in control nerves. The free cholesterol behaved like the myelin lipides except that the injured nerves contained cholesterol esters (not found in normal nerves) which, however, completely disappeared by the 144th day. The total phospholipide and sphingomyelin followed the same course as the myelin lipides, but cephalin was decreasing more rapidly and lecithin more slowly, and the latter was not restored beyond the concentration attained after 64 days.
S. MORGULIS (Chem. Abstr.).

Brain Metabolism In Vivo. (II) The Distribution of Lesions Caused by Azide, Malononitrile, Plasmocid and Dinitrophenol Poisoning in Rats. Hicks, Samuel P. (New England Deaconess Hosp., Boston, Mass.). [*Arch. Path.*, **50**, 545-61 (1950); cf. *C. A.*, **44**, 7430h.]

In white rats, acute azide poisoning caused lesions mainly in the corpus callosum, corpus striatum and optic tracts. Malononitrile caused lesions in the corpus striatum. Plasmocid and 2, 4-dinitrophenol damaged skeletal and heart muscle, and the former, but not the latter, produced lesions in the trigeminal ganglion.
M. L. C. BERNHEIM (Chem. Abstr.).

INDEX TO VOL. XCVII.

The General Index covers original articles, reviews and the epitome.

The following names are printed in SMALL CAPITALS: Authors of original articles and of books reviewed. Names of authorities referred to in the text are in ordinary type.

(R.) indicates a *Review*; the title of the book reviewed is followed by the author's name, thus: "Psychoanalysis and its Derivatives, by H. Crichton-Miller (R.)."

(E.) indicates the *Epitome* section; the title of the abstract is followed by the author's name, thus: "Age and human ability. Miles, W. R. (E.)."

The names of authors referred to in the Epitome section are listed in Part II.

PART I.—GENERAL INDEX.

- Acetaldehyde in relation to intoxication by ethyl alcohol. MacLeod, L. D. (E.), 249
- Acetylcholine, anemia due to. Fornaroli, P., and Antona, G. (E.), 620
- " content of the brain, effects of anesthetics and convulsants on. Elliott, K. A. C., *et al.* (E.), 619
- " effect of, on the resistance of guinea-pigs to anoxaemia. Franck, C., *et al.* (E.), 619
- " the electromotive action of, at the motor end-plate. Fatt, P. (E.), 853
- " electrophysiological analysis of the action of, on nerve centers, II. Artem'ev, V. V., and Babskii, E. B. (E.), 429
- " factors affecting the synthesis of, by brain slices. McLennan, H., and Elliott, K. A. C. (E.), 854
- " the mechanism of synthesis of, II. Persky, H., and Guzman Barron, E. S. (E.), 854
- " relation between the reflex erythemas following intracutaneous injection of, etc. Kohler, V., *et al.* (E.), 429
- " role of, in nerve activity. de Roeth, A., jun. (E.), 612
- " like action of a product formed by an acetylating enzyme system derived from brain. Middleton, S., and H. H. (E.), 255
- A.C.T.H., effects of, in patients with mental disease. Altschule, M.D., *et al.* (E.), 405
- " therapy, effects of. Hoefer, P. F. A., and Glaser, G. H. (E.), 434
- Adler's Place in Psychology, by L. Way. (R.), 597
- Adrenergic vasodilator fibres, do they exist? Folkow, B., and Uvnas, B. (E.), 621
- Agene-induced convulsions in dogs, effect of some anticonvulsant agents on. Belford, J., and Bonycastle, D. D. (E.), 439
- " " some biochemical changes observed during. Belford, J., and Bonycastle, D. D. (E.), 601
- Alcohol, the effect of, on liver lipids and on liver and heart glycogen. Forbes, J. C., and Duncan, G. M. (E.), 249
- " barbiturate synergism. Ramsey, H. J., *et al.* (E.), 852
- Alcoholic intoxication, drugs accelerating and inhibiting. Chauchard, P., *et al.* (E.), 439
- Alcoholism, the anxiety syndrome in. William, E. Y. (E.), 424
- Alien's paranoid reaction, by F. F. Kino, 589
- Allen, C., The Sexual Perversions and Abnormalities. (R.), 221
- Amino-acid mixtures and mental function. Rauch, F., and Schwobel, G. (E.), 252
- " of nervous tissue. Roberts, E., *et al.* (E.), 432
- Anoxybiotic processes in frog nerve. Aykut, R., and Winterstein, H. (E.), 435
- Antabuse and alcohol, the role of acetaldehyde in the toxicity of. Lester, D., and Greenberg, L. A. (E.), 249
- " the effect of, on the metabolism of ethyl alcohol. Newman, H. W., and Petzold, H. V. (E.), 849
- " " " " of lactic acid in the human organism. Jokivartio, E. (E.), 630
- " mechanism of the action of, on alcoholism. Christensen, J. A. (E.), 849
- " and the metabolism of alcohol. Newman, H. W. (E.), 630
- " therapy in chronic alcoholism. Dale, P. W., and Ebaugh, F. G. (E.), 630
- " treatment of alcoholism with. Carratala, R. (E.), 439
- " " " in a general hospital, experiences with. Bennett, A. E., *et al.* (E.), 415
- Anti-convulsant action of some phenylhydantoins, etc. Swinyard, E. A., *et al.* (E.), 633
- " drugs. Spielman, M. A., *et al.* (E.), 632
- " properties of benadryl and pyribenzamine. Swinyard, E. A., *et al.* (E.), 629
- Antithiamine factor, of bracken fern, action of, on peripheral nerves. Konecni, E. B., and Murrall, A. v. (E.), 252

- Anxiety states, life situations, emotions and the excretion of hippuric acid in. Persky, H., *et al.* (E.), 856
- Ask the Children, by Ford Thompson (R.), 220
- Aspirin poisoning, a case of, by A. A. Robin, 214
- "Associative Areas" in monkeys, effects of combined destruction of frontal and posterior. Chow, K. L., *et al.* (E.), 612
- Athetosis and the basal ganglia. Carpenter, M. B. (E.), 228
- Ausdrucksprache der Seele (The Language of the Expressions), by K. Leonhard (R.), 219
- Autobiography, by W. Stekel (R.), 220
- Autonomic nervous system, effects of a new quarternary amine and a new imidazoline derivative on the. Longino, F. H., *et al.* (E.), 438
- Awareness, studies in the physiology of, by J. W. Lovett Doust, 801
- " " " " Doust, J. W. Lovett (E.), 846
- BABKIN, B. P., Pavlov : a Biography (R.), 596
- Barbiturate action, the enzymic mechanism of. Persky, H. (E.), 632
- " intoxication, chronic. Isbell, H., *et al.* (E.), 231
- " " psychological effects of chronic. Kornetsky, C. H. (E.), 826
- " narcosis, hyperkinesis of mesencephalic origin, which arises in frogs under. Markova, I. V. (E.), 437
- Barbiturates, action of various on the parenchymatous organs in narcosis of long duration. Carlon, C., and Mondini, P. (E.), 631
- " effect of some surface-active agents on the action of. Cole, V. V., *et al.* (E.), 437
- " and hyoscine, effect on marksmanship of some motion sickness preparations containing. Tyler, D. B. (E.), 437
- " pain relief with hypnotic doses of, and a hypothesis. Keap, A. S., and Beecher, H. K. (E.), 631
- Barbituric acid derivatives, a method for the prevention of suicidal deaths caused by the. Miskimon, R. M., and R. R. (E.), 436
- " " rate of penetration of, into the brain. Butler, T. C. (E.), 631
- " " in urine in the presence of sulfonamides, identification of. Mohrschulz, W. (E.), 437
- " " the excretion of, during continued sleep treatment of schizophrenia, etc. Staub, H. (E.), 631, 632
- LE BEAU, J., the surgical uncertainties of prefrontal lobectomy and leucotomy, 480
- Behavioural and electroencephalogram changes following chronic brain stem lesions in the cat. Lindsley, D. B. (E.), 607
- Benzedrine, the effect of, on the post-electroshock electroencephalogram. Lennox, M. A., *et al.* (E.), 832
- Blood-brain barrier, II. Hurst, E. W., and Davies, O. L. (E.), 433
- " destruction and cerebral damage in hemolytic disease of the newborn. Kuster, F., and Krings, H. (E.), 433
- BONE, A. D., and WEIL-MALHERBE, H., activators and inhibitors of hexokinase in human blood, 635
- BRADFORD, E. J. G., and FORSTER, W., cytochrome C in senile and arteriosclerotic dementia, 718
- Brain abscess, loss of written language due to dissolution of the phonetic structure of the word in, by R. Klein, 328
- " acetal phospholipids of, I. Thannhauser, S. J., *et al.* (E.), 856
- " the aldehydes of the acetal phosphatides of the. Leupold, F. (E.), 858
- " β -glucosidase in the. Kartasheva, N. V., and Rozengart, V. I. (E.), 435
- " biopsies and topectomies, comparative morphologic and histometabolic studies of nerve-cells in. Roizin, L. (E.), 838
- " concussion and blood sugar. Mate, I. (E.), 626
- " cortex, concentration or exclusion of some heterocyclic compounds by, etc. McIlwain, H., and Gringer, I. (E.), 623
- " a cytoplasmic constituent of. Dixon, K. C., and Herbertson, B. M. (E.), 854
- " decarboxylation of L-glutamic acid by. Wingo, W. J., and Awapara, J. (E.), 857
- " excitability, effect of A.C.T.H., etc., on. Woodbury, D. M., *et al.* (E.), 854
- " enzyme, a report on the current status of an attempt to correlate abnormality of distribution of one, with mental dysfunction. Ashby, W. (E.), 415
- " extracts, sympathomimetic action of. Holtz, P. (E.), 622
- " hemolytic acid present in horse, I and II. Morton, I. D., *et al.* (E.), 858
- " identification of γ -aminobutyric acid in, by the isotope derivative method. Udenfriend, S. (E.), 858
- " lesions in the rat produced by large doses of desoxycorticosterone acetate. Fari-bault, C., and Havar, P. (E.), 253
- " metabolism *in vivo*, I. Hicks, S. P. (E.), 435
- " " " " II. Hicks, S. P. (E.), 860

- Brain of normal and hypophysectomized rats, effect of certain analgesic drugs, etc., on. Zander, H. L. (E.), 852
- „ oxidations, the depression of, II. Wilkins, D. S., *et al.* (E.), 252
- „ pH response to CO₂ after prolonged hypoxic hyperventilation, changes in. Brown, E. B., jun. (E.), 432
- „ potentials, synchronized recording of, etc. Fellenius, V. (E.), 432
- „ respiration, effects of atropine on. Cavanaugh, D. J. (E.), 852
- „ „ and phosphorylation in preparations from mammalian. Case, E. M., and McIlwain, H. (E.), 858
- „ in tetanus, nitrogen metabolism in the. Promyslov, M. S., and Pletsityi, D. F. (E.), 859
- „ tissue, phosphatase of. Binkley, F., and Olson, C. K. (E.), 685
- „ tumours, the experimental application of ultrasonics to the localization of. French, L. A., *et al.* (E.), 841
- BROWN, G. B., Science: Its Method and its Philosophy (R.), 397
- Brucine, disappearance of the convulsant action of, when converted to its methiodide. Busquet, H., and Vischniac, C. (E.), 439
- Bulbar respiratory center site and extension of. Woldring, S., and Dirkin, M. N. J. (E.), 843
- BULLOCK, F. N., *et al.*, studies in schizophrenia, 197
- Carbonic anhydrase in the brain of the newborn in relation to functional maturity. Ashby, W., and Schuster, E. M. (E.), 621
- „ „ in the nervous system. Kreps, E. M. (E.), 435
- Caro, The Maggid of, by H. L. Gordon (R.), 398
- CAROTHERS, J. C., frontal lobe function and the African, 12
- CASPERSSON, T. O., Cell Growth and Cell Function (R.), 596
- Cell Growth and Cell Function, by T. O. Caspersson (R.), 596
- Central nervous system, the action of hexachlorocyclohexane on the. Herken, H. (E.), 629
- „ „ „ alterations of vascular origin in the, in CS₂ poisoning. Vigliani, E. C., and Cazzullo, C. L. (E.), 433
- „ „ „ arsenic and arsenic compounds in the. Grzycki, S., and Kobusowna, B. (E.), 252
- „ „ „ of the cat, the action of *d*-tubocurarine chloride on the. Salama, S., and Wright, S. (E.), 256
- „ „ „ distribution, exchange and migration of phosphate compounds in the. Samuels, A. J., *et al.* (E.), 857
- „ „ „ of persons without pernicious anemia, absence of a toxic effect of folic acid on the. Harvey, E. A., *et al.* (E.), 438
- „ „ „ properties of preparations from the, which degrade coenzymes. McIlwain, H. (E.), 623
- „ „ „ sites and mechanisms of action of morphine and related drugs in the. Wikler, A. (E.), 653
- „ „ „ silver impregnation of degenerating axon terminals in. Nauta, W. J. H., and Gyax, P. A. (E.), 859
- Cephalinase in nervous tissue. Tyrrell, L. W. (E.), 624
- Cerebellar cortex, spike discharges of single units in the. Brookhart, J. M., *et al.* (E.), 418
- „ waves, origin of. Brookhart, J. N., *et al.* (E.), 843
- Cerebellum, recent contributions to the anatomy and physiology of the. Snider, R. S. (E.), 232
- Cerebral angiography. Roach, J. F. (E.), 433
- „ anoxia in infantile dehydration. Kerpel-Fronius, E., *et al.* (E.), 624
- „ blood flow in male subjects, etc. Scheinberg, P., and Stead, E. A. (E.), 625
- „ blood flow and metabolism in human subjects, effect of desoxycorticosterone glucoside upon. Bentinck, R. C., *et al.* (E.), 856
- „ circulation and metabolism in man, effects of various drugs upon. Shenkin, H. A. (E.), 851
- „ „ „ „ intravenously administered aminophylline on. Weschler, R. L., *et al.* (E.), 440
- „ cortex, changes in excitability of following single electric shock applied to cortical surface. Chang, H-T. (E.), 842
- „ „ dendritic potential of cortical neurones produced by direct electrical stimulation of the. Chang, H-T. (E.), 612
- „ „ in man, some data concerning the growth and development of the, II. Turner, O. A. (E.), 234
- „ functions in essential hypertension impaired. Apter, N. S., *et al.* (E.), 822
- „ processes, the evaluation of, by the intravenous insulin functional test, etc. Reiss, E. (E.), 624

- Cerebral tissues, lethal barium chloride poisoning with special reference to changes in the
Fazekas, I. G. (E.), 630
- Cerebro-spinal fluid and blood, examination of. Lange, C., *et al.* (E.), 621
- " " lead content of, in experimental lead poisoning. Straube,
G. (E.), 430
- " changes of acid-base and electrolytic equilibria in human, during
spinal anaesthesia. Forni, P. (E.), 255
- " " in normal by the action of streptomycin. Araya, N. T. (E.),
430
- " or diluted blood serum, microphotometric determination of globulin
and total protein in. Salt, H. B. (E.), 430
- " determination of the problems in the. Hinsberg, K., and Gleiss, J.
(E.), 429
- " a direct detection of protective proteinases in the. Abderhalden, R.,
and Elsaesser, K. H. (E.), 255
- " the indican content of the, in physiological and pathological conditions.
Tinelli, G. (E.), 621
- " the influence of calcium, potassium and magnesium ions in, on vaso-
motor system. Leusen, I. (E.), 256
- " method of application of the Abderhalden reaction to the. Elsaesser,
K. H. (E.), 853
- " in methyl alcohol poisoning. Reiner, E. R. (E.), 404
- " in multiple sclerosis. Freedman, D. A., and Merritt, H. H. (E.),
621
- " the penetration of particulate matter from the, into the spinal ganglia,
etc. Brierley, J. B. (E.), 242
- " in premature infants. Otila, E. (E.), 430
- " preparation of crystalline protective proteinases from the. Abder-
halden, R., and Elsaesser, K. H. (E.), 256
- " the proteins and the hydrochloric acid-collargol reaction of the.
Pérez-Tores, A., and Fontan, J. L. R. (E.), 620
- " results obtained by application of the Abderhalden reaction to.
Flügel, F. (E.), 853
- " studies in the iron content of, in different psychotic conditions.,
Lehmann, H. E., and Kral, V. A. (E.), 825
- " tannic index of serum proteins for the determination of total proteins
in the. Ravier, H. (E.), 653
- " vitamin B₁ in, in inflammations of the brain and the meninges. Blume
and Puschel. (E.), 430
- Character Analysis, by W. Reich. (R.), 815
- Chloride levels in the blood of alcoholic patients in relation to the phenomenon of craving.
Silkworth, J. D., and Texon, M. (E.), 249
- Cholinesterase and acid phosphatase, histochemical distribution of, in the prefrontal
cortex, etc. Pope, A., *et al.* (E.), 619
- " activity of the brains of physostigmine-poisoned rats, the true. Kalsbeek,
F., and Cohen, J. A. (E.), 255
- " " of, in various organs, etc. Speranskaya, E. N. (E.), 429
- " the effect of glycerophosphocholine on the action of. Stern, P., and Režek,
A. (E.), 254
- Cholinesterases of serum and brain, comparative action of eserine and pilocarpine on the.
Vincent, D., and Lagreu, R. (E.), 257
- Choroid plexus, alkaline phosphatase in the. Firket, H., *et al.* (E.), 435
- Cingular gyrus and adjacent areas in monkeys, the effects of lesions in the. Glees, P., *et al.*
(E.), 242
- Cingulate gyrus, gastric motor effects of removal of, and section of brain stem. Babkin,
B. P., and Kite, W. C., jun. (E.), 417
- CLANCEY, I. W., *et al.*, studies in schizophrenia, 197
- COBB, W. A., *et al.*, Electroencephalography (R.), 397
- Colloidal gold reaction in multiple sclerosis. Starch, T. J. C., *et al.* (E.), 405
- Convulsions, effect of generalized, on the blood histamine in man. Gabraoui, B., and
Abdel-Nabi, S. (E.), 857
- " the relation between the elicitation of, and the inhibition of the enzymic
decomposition, etc. Hellauer, H. F., and Umrath, K. (E.), 628
- Convulsive activity, temperature and. Teschan, P., and Gellhorn, E. (E.), 856
- CORSELLIS, J. A. N., sub-acute sclerosing leuco-encephalitis, 570
- Cortical dysrhythmia in psychiatry, further observations on the use of combined photic
and chemically induced, by P. M. O'Flanagan *et al.*, 174
- " projection of vestibular and facial nerves in cat. Kempinsky, W. H. (E.), 843
- " stimulation, drug effects on the results of minimal. Whielson, J. A., and van
Harreveld, A. (E.), 832
- " undercutting, selective. Scoville, W. B., *et al.* (E.), 821

- Corticofugal connections of posterior orbital surface in Rhesus monkey. Wall, P. D., *et al.* (E.), 829
- COWIE, V., phenylpyruvic oligophrenia. 505
- CREAK, M., psychoses in childhood, 545
- Crime in the psychoses complicating pellagra, by M. K. el Kholy, 191
- CROFT, P. G., some observations on neuroses in farm animals, 584
- CROME, L., the pathogenesis of somatic disease in mental defectives, 792
- CROOKES, T. G., and HALL, K. R. L., studies in learning impairment, I, 725
- CROWN, S., psychological changes following prefrontal leucotomy, 49
- Curarizing agents and experimental epilepsy in the rat. Quivy, D., *et al.* (E.), 436
- " " " in man, evaluation of. Unna, K. R., *et al.* (E.), 628
- Cytochrome C in senile and arteriosclerotic dementia, by W. Forster and E. J. G. Bradford, 718
- " oxidase, effect of convulsant and anti-convulsant agents on the activity of. Torda, C., and Wolff, H. G. (E.), 632
- DAX, E. C., *et al.*, comments on the opening papers on indications for shock treatment, 132
- Decamethonium iodide in electric convulsion therapy. Holt, W., *et al.* (E.), 822
- Delinquency and human nature, by H. D. Stott (R.), 219
- Deoxycortone with ascorbic acid in mental disorders. Cranswick, E. H., and Hall, T. C. (E.), 440
- Depression, the treatment of, by dinitrile succinate, by A. Harris, 209
- D-desoxyephedrine HCl in the study of psychopathology and psychotherapy, a preliminary report on the use of. Shein, J., and Goolker, P. (E.), 822
- Dehydrogenase action in the sliced brain tissue of the rat, the, I and II. Tadokora *et al.* (E.), 855
- DOUST, J. W. LOVETT, studies in the physiology of awareness, 801
- Drawings made by various clinical groups, a comparative study of, by A. W. Martin and A. J. Weir, 532
- DRURY, K. K., The Past and the Future: Presidential Address, 1
- Dura mater, permeability of, to epidural procaine in dogs. Rudin, D. O., *et al.* (E.), 852
- Electric convulsion therapy as compared with conservative methods of treatment in depressive states, evaluation of, by E. T. O. Slater, 567
- " " " given to a patient with a tantalum plate in his skull, an account of. Osmond, H. 381
- " " " focal electroencephalogram changes in unilateral. Blaurock, M. F., *et al.* (E.), 232
- " " " square waves (B.S.T.) versus sine waves in. Bayles, S., *et al.* (E.), 224
- " convulsions, physiology of. Ammon, R., and Ohm, G. (E.), 253
- " shock, motor, respiratory, cardiovascular and blood-sugar changes during. Piette, Y. (E.), 253
- Electric stimulation therapy, non-convulsive. Alexander L. (E.), 401.
- Electrocardiography with an electroencephalograph, clinical, by W. Fabisch and E. G. Williams, 812
- Electroconvulsions, effects of Cro and *d*-tubocurarine on. Margolis, L. H., *et al.* (E.), 603
- Electrocorticogram of rabbit, effect of intravenous injections of casein hydrolyzate on. King, R. B., *et al.* (E.), 854
- Electrocorticographic effects of stimulation of posterior orbital, temporal and cingulate areas of *Macacca mulatta*. Lennox, M. A., *et al.* (E.), 417
- Electroencephalography, by W. Grey Walter *et al.* (R.), 397
- Electroencephalogram changes in experimental convulsions caused by divided injections of metrazole. Muller, H. W. (E.), 851
- " " " in toxemia of late pregnancy, the effect of ammonium chloride upon the. Parviainen, S., *et al.* (E.), 860
- " cortical rhythms not seen in the. Williams, D., and Parsons-Smith, G. (E.), 407
- " the, during hyperventilation followed by apnoea. Lloyd-Smith, D. L. (E.), 409
- " findings in 186 cases of chronic post-traumatic encephalopathy. Clark, E. C., and Harper, E. O. (E.), 832
- " in Korsakoff syndrome, the. Gorman, W. F., *et al.* (E.), 224
- " modifications of the, caused by tetraethylammonium ion. Jiminez-Vargas, J., and Molins, M. (E.), 855
- " psychic function and the. Ostow, M. (E.), 234
- " of the rabbit, action of curarizing agents on the. Quivy, D., *et al.* (E.), 436
- " remarks on, in cerebral abscess. Farbroth, O. (E.), 399
- Electrophorus electricus*, characteristics of responses from electrogenic tissue of. Albe-Fessard, D., *et al.* (E.), 843

- Electroshock, blood, adrenaline in. Kinzius, H., and Hann, J. (E.), 852
 " blood-sugar in. Valerio, V., and Cataldi, L. (E.), 629
 Encephalin in brain of humans and animals, concentration and distribution of. Raab, W., and Giege, W. (E.), 857
 Encephalitis, allergenic and its possible relation to human disease. Peers, J. H. (E.), 435
 Endocrine Diagnosis, by H. Ucko (R.), 816
 Epilepsy, analysis of physiological processes underlying experimental reflex. Krushinskii, L. V., *et al.* (E.), 436
 " the behaviour of potassium and calcium in the blood serum in. Weinland, W. L. (E.), 624
 " the incidence of focal and non-focal abnormalities in clinical. Kershman, J., *et al.* (E.), 832
 " medical therapy of. Carter, S., and Merritt, H. H. (E.), 256
 " neurotic tendencies in. Eysenck, M. D. (E.), 242
 " of psychomotor type, focal. Green, J. R., *et al.* (E.), 841
 Epileptic, intellectual and emotional make-up of the. Zimmerman, F. T., *et al.* (E.), 826
 Epileptogenic zone of the brain, shifts in ammonia content of the. Budanova, A. M. (E.), 855
 Ether abreaction therapy, three aspects of ego-organization in relation to, by H. Palmer, 388
 " an estimation of its use in the treatment of the psychoneurosis, by D. Gilmour, 148
 Etudes Psychiatriques by H. Ey. (R.), 817
 Ey, H., Etudes Psychiatriques (R.), 817
 EYSENCK, H. J., and PRELL, D. B., the inheritance of neuroticism, 443
 FABISCH, W., and WILLIAMS, E. G., clinical electrocardiography with an electroencephalograph, 812
 FANG, T. C., a note on the *a*-bridge count and intelligence, 394
 FLEISCHHACKER, H. H., *et al.*, studies in schizophrenia, 197
 FODOR, N., and GAYNOR, F., Freud : Dictionary of Psychoanalysis (R.), 397
 FORD THOMPSON, Ask the Children (R.), 220
 FORSTER, W., and BRADFORD, E. J. G., cytochrome C in senile and arteriosclerotic dementia, 718
 Freud : Dictionary of Psychoanalysis, by N. Fodor and F. Gaynor (R.), 397
 " or Jung, by E. Glover (R.), 220
 Frontal lobe function and the African, by J. C. Carothers, 12
 " " and intelligence. Halstead, W. C. (E.), 606
 " lobes and emotion. Nielsen, J. M. (E.), 606
 " lobotomy, some physical and pharmacological factors affecting delayed response performance of baboons following. Pribram, K. H. (E.), 417
 Frustration, by N. R. F. Maier (R.), 595
 GARDNER, L. D., Priscot in circulatory deficiency, 278
 GAYNOR, F., and FODOR, N., Freud : Dictionary of Psycho-analysis (R.), 397
 GIBSON, H. G., *et al.*, cortical dysrhythmia in psychiatry, etc., 174
 GILMOUR, D., ether : an estimation of its use in the treatment of the psychoneuroses, 148
 Glutamic acid and glutamine, uptake of, by brain and other tissues of the rat and mouse. Schwerin, P., *et al.* (E.), 431
 " " and glucose as substrates for mammalian brain, by H. McIlwain, 674
 " " an investigation into the effects of, on human intelligence. Milliken, J. R., and Slanden, J. L. (E.), 842
 " " and its salts in *petit mal* epilepsy, by D. A. Pond and M. H. Pond, 663
 " " role of, in the transport of potassium in brain and retina. Ternier, C., *et al.* (E.), 625
 " " in the treatment of mentally handicapped children. Clapp, R. W. (E.), 627
 " " treatment, permanency of, Zimmerman, F. T., and Burgemeister, B. B. (E.), 825
 Glutamine and glutamic acid in mental patients, determination of. Munkrad, I. (E.), 399
 GLOVER, E., Freud or Jung (R.), 220
 GOLDMAN-EISLER, F., the problem of " orality " and of its origin in early childhood, 755
 Gonadotropin in spinal fluid in a case of twin pregnancy. Brody, H., and Horowitz, E. A. (E.), 256
 GORDON, H. L., The Maggid of Caro (R.), 398
 GREVILLE, G. D., *et al.*, Electroencephalography (R.), 397
 Group-approach to Leadership-testing, The, by H. Harris (R.), 217
 Grundlagen der Psychiatrie (Fundamentals of Psychiatry), by K. Leonhard (R.), 217
 HALL, K. R. L., and CROOKES, T. G., studies in learning impairment, I, 725
 HARRIS, A., the treatment of depression by dinitrile succinate, 209

- HARRIS, H., The Group-approach to Leadership-testing (R.), 217
 Hepatolenticular degeneration. Herz, E., and Drew, A. L., jun. (E.), 228
 HEPPENSTALL, M. E., *et al.*, Electroencephalography (R.), 397
 Hexokinase, activators and inhibitors of, in human blood, by H. Weil-Malherbe and Bone, A. D., 635
 HILL, DENIS, *et al.*, a central homeostatic mechanism in schizophrenia, 111
 " Electroencephalography (R.), 397
 Histamine and nicotinic acid, the spasm-preventing effect of, on experimental human convulsions. Kajtor, F. (E.), 629
 " and other vasodilating drugs, the anti-convulsive action of, on experimental convulsions in man. Kaytor, F. (E.), 611
 HOENIG, J., fifty cases of epilepsy treated with " tridione," 362
 Holzinger's h^2 , statistic, note on the assumptions underlying, by J. May, 466
 Homeostatic mechanism in schizophrenia, a central, by Denis Hill *et al.*, 111
 " Hydergin-glucose-test," the relation of, to psychic and physical status. Solma, H. (E.), 626
 Hypnosis? what is, by A. Salter (R.), 597
 Hypophyseal changes following hypothalamic injuries. Soulairac, A., and Desclaux, P. (E.), 434
 Hypothalamic lesions, the effect of morphine on cats with. McCrum, W. R., and Ingram, W. R. (E.), 838
 Hypothalamus and cerebral cortex, physiological relationships between. Ingram, W. R., *et al.* (E.), 832
 " and medulla, some functional connections between. Thompson, W. C., and Bach, L. M. N. (E.), 418
 Inhibition of anaerobic glycolysis of brain by sodium ions, mechanism of. Utter, M. F. (E.), 623
 Intelligence and modern social trends, by E. O. Lewis, 468
 " a note on the *a-b* ridge count and, by T. C. Fang, 394
 Isopropanol, anticonvulsant action of. Schaffarzick, R. W. (E.), 439
 JONES, A. M., and REES, W. LINFORD, an evaluation of the Rorschach test as a prognostic aid in the treatment of schizophrenia, etc., 681
 KALDEGG, A., an account of the Szondi test, 555
 KHOLY, M. K. EL, crime in the psychoses complicating pellagra, 191
 KINO, F. F., alien's paranoid reaction, 589
 KIRMAN, B. H., anomalous physical signs of bodily disease in mental deficiency, 783
 KLEIN, R., loss of written language due to dissolution of the phonetic structure of the word in brain abscess, 328
 Klinische Psychopathologie, by K. Schneider (R.), 816
 Learning impairment, studies in, I, by K. R. L. Hall and Crookes, T. G., 725
 LEONHARD, K., Ausdruckssprache der Seele (R.), 219
 " Grundlagen der Psychiatrie (Fundamentals of Psychiatry) (R.), 217
 Leuco-encephalitis, sub-acute sclerosing, by J. A. N. Corsellis, 570
 LEWIS, AUBREY, the Twenty-fifth Maudsley Lecture—Henry Maudsley, His Work and Influence, 259
 LEWIS, E. O., intelligence and modern social trends, 468
 Limbic cortex, studies of the regulatory functions of the anterior. Sloan, N., and Jasper, H. (E.), 409
 Lobotomy, anatomical study of. Yakovlev, P., and Sweet, W. H. (E.), 243
 " and psychopathology. Reiner, E. R., and Sands, S. L. (E.), 602
 " sexual behaviour after. Levine, J., and Albert, H. (E.), 839
 LOE, P. ST. J., *et al.*, a central homeostatic mechanism in schizophrenia, 111
 LORAND, S., Technique of Psychoanalytic Therapy (R.), 816
 LOW, A. A., Mental Health Through Will Training (R.), 597
 L.S.D.-25 experimental physiological studies with. Forrer, G. R., and Goldner, R. D. (E.), 826
 McILWAIN, H., glutamic acid and glucose as substrates for mammalian brain, 674
 MAIER, N. R. F., Frustration (R.), 595
 Malononitrile, action of, on the central nervous system. Reale, G. (E.), 857
 " further experiences of the use of, in the treatment of mental illnesses. Hartelius, H. (E.), 225
 Manic depressive psychosis, analysis of temporal factors in, etc. Oltman, J. E., and Friedman, S. (E.), 224
 MARTIN, A. W., and WEIR, A. J., a comparative study of the drawings made by various clinical groups, 532

- Maudsley Lecture, The Twenty-fifth—Henry Maudsley: His Works and Influence, by Aubrey Lewis, 259
- MAY, J., note on the assumptions underlying Holzinger's h^2 statistic, 466
- MAYER-GROSS, W., *et al.*, comments on the opening papers on indications for shock treatment, 132
- Memory studies in electric convulsion therapy. Williams, M. (E.), 612
- Mental achievement of congenitally hypothyroid children. Topper, A. (E.), 857
- „ defectives, the pathogenesis of somatic disease in, by L. Crome, 792
- „ deficiency, anomalous physical signs of bodily disease in, by B. H. Kirman, 783
- „ disease, effect of treatment on excretion of 17-ketosteroids in patients with. Altschule, M. D., and Parkhurst, B. H. (E.), 404
- „ „ peculiar to certain cultures, by P. M. Yap, 313
- „ Health Through Will Training, by A. A. Low (R.), 597
- Metrazole activation of acetylcholine-treated cerebral cortex. Forster, F. M., and Madow, L. (E.), 439
- „ and coramine, the site of action of, V and VI. Hahn, F., *et al.* (E.), 633
- Migraine as a form of neurasthenia, I. Gans, M. (E.), 839
- MINSKI, L., A Practical Handbook of Psychiatry for Students and Nurses (R.), 221
- Mongolism, maternal age in familial, by L. S. Penrose, 738
- Morphogenesis, biochemical and physiological differentiation during, X. Flexner, L. B., *et al.* (E.), 418
- MULLAHY, P., Oedipus, Myth and Complex (R.), 595
- Multiple sclerosis, biochemical studies in. Jones, H. H., *et al.* (E.), 626
- Myanesis, action of, on medullary synaptic transmission in the acute spinal dog. Baisset, A., *et al.* (E.), 438
- „ the mode of action of, on the central nervous system. Henneman, E., and Scherrer, J. (E.), 629
- Myelin, chemical composition of. Brodal, A., and Harrison, R. G. (E.), 435
- Myelination and demyelination, the chemistry of. Sperry, W. M., and Waelsch, H. (E.), 624
- Narcotic and stimulating action, action of certain substances with, etc. Zakusov, V. V. (E.), 437
- Narcotics on cell respiration, effect of. Issekutz, B., jun., *et al.* (E.), 627
- „ and the inorganic and creatine phosphates of mammalian brain. Buchel, L., and McIlwain, H. (E.), 851
- „ and the phosphates of the brain. Buchel, L., and McIlwain, H. (E.), 628
- Neocortex, adaptive behaviour in long-surviving dogs without. Wikler, A. (E.), 231
- Nerve, biochemical studies on the action of the. Okinaka, S., *et al.* (E.), 626
- „ signal transmission in. von Muralt, A. (E.), 622
- „ system regulating metabolism, pharmacology of the. Issekutz, B., sen. and jun. (E.), 630
- „ network, the stability of a randomly assembled. Ashby, W. Ross. (E.), 607
- Nervous centers, action of *d*-tubocurarine. Arduini, A., and Zanchetti, A. (E.), 436
- „ activity, determination of the ionic exchange during, by activation analysis. Keynes, R. D., and Lewis, P. R. (E.), 431
- „ „ in dog, effect of partial extirpation of adrenals on the higher. Gzyzgan, D. M. (E.), 622
- „ system, changes of functional state of the, in protein deficiency. Dinerman, A. A., and Semenova, G. T. (E.), 621
- „ „ pharmacological action of β -phenylisopropylamine on the. Scarinci, V. (E.), 627
- „ tissues after arrest of circulation, survival and revival of. Heymans, C. (E.), 622
- Neurological staining, synthesis of silver proteinates for. Porter, R. W., and Davenport, H. A. (E.), 859
- Neuromuscular blocking action of succinylcholine. Castillo, J. C., and De Beer, E. J. (E.), 627
- „ transmission, comparison of the effect of ether and curare on the, etc. Naess, K. (E.), 257
- „ excitation. Jarcho, L. W., *et al.* (E.), 628
- Neuroses in farm animals, some observations on, by P. G. Croft, 584
- Neurosyphilis, cerebral blood flow and oxygen consumption in. Patterson, J. L., jun., *et al.* (E.), 626
- Neuroticism, the inheritance of, by H. J. Eysenck and D. B. Prell, 443
- Niacinamide in bromide intoxication. Harris, R. S., and Derian, P. S. (E.), 438
- Nonconvulsive electric stimulation therapy. Alexander, L. (E.), 401
- Nucleic acids of the brain during prolonged protein starvation. Mandel, L., *et al.* (E.), 622
- Oedipus, Myth and Complex, by P. Mullahy (R.), 595

- O'FLANAGAN, P. M., *et al.*, cortical dysrhythmia in psychiatry, etc., 174
- Oligodendrogliomas. Earnest, F., *et al.* (E.), 228
- Oligophrenia, excretion of phenylalanine and derivatives in phenylpyruvic. Jervis, G. A. (E.), 620
- " phenylpyruvica. Borek, E., *et al.* (E.), 620
- " phenylpyruvic. Mautner, H., and Quinn, K. V. (E.), 620
- " " by V. Cowie, 505
- OSMOND, H., an account of electric convulsion therapy given to a patient with a tantalum plate in his skull, 381
- "Orality" and its origin in early childhood, the problem of, by F. Goldman-Eisler, 765
- Organic cerebral disease, fits of laughter in. Martin, J. P. (E.), 829
- Oxalacetic and pyruvic carboxylases, effect of convulsant and anti-convulsant agents on activity of. Torda, C., and Wolff, H. G. (E.), 257
- PALMER, H., three aspects of ego-organization in relation to ether abreaction therapy, 388
- Parabolic nature of central nerve control and the teachings of I. P. Pavlov. Magnitskii' A. N. (E.), 253
- Past and the Future, the, Presidential Address, by K. K. Drury, 1
- Parasympathetic stimulant, a new. Ballem, C. M., *et al.* (E.), 630
- Parenchymatous neurosyphilis, permeability of the blood-brain barrier to penicillin in cases of, by R. H. F. Smith, 340
- Pavlov: a Biography, by B. P. Babkin (R.), 596
- PENROSE, L. S., maternal age in familial mongolism, 738
- Pentobarbital poisoning of rabbits, the value of artificial respiration in. Shack, J. A., *et al.* (E.), 436
- Perceptivity, the effect of *d*-tubocurarine chloride on human. Kellgren, J. H., *et al.* (E.), 436
- Perceptual anomaly, experimental studies of a, by M. B. Shapiro, 90
- Phenamine, action of, on the higher nervous activity of the dog. Pavlov, B. V. (E.), 628
- Phenurone in the treatment of psychomotor attacks. De Jong, R. N. (E.), 822
- Phenylpyruvic oligophrenia in the dark-skinned person. Fernandes, J. F. (E.), 855
- Phosphatases in the nervous system of thiamine-deficient pigeons, histochemical studies of Shimizu, N., *et al.* (E.), 855
- Photoc activation in idiopathic epilepsy, an experimental study of the mechanism of. Gastaut, H., and Hunter, J. (E.), 409
- Poliomyelitis, IV, a study of the midbrain. Matzke, H. A., and Baker, A. B. (E.), 601
- POND, D. A., and M. H., glutamic acid and its salts in *petit mal* epilepsy, 663
- Potassium permeability of the myelin sheath of vertebrate nerve. Harreveld, A. von (E.), 431
- Prefrontal leucotomy, personality changes following, etc., by M. Vidor, 159
- " " psychological changes following, by S. Crown, 49
- " " pneumoencephalographic changes following. Mescham, I., and Scruggs, J. B. (E.), 602
- " lobotomies, preliminary report of sixty-two, on psychotic male veterans. Drubin, L. (E.), 415
- " lobotomy in chronic schizophrenia, clinical and psychological investigation of. Carscallen, H. B., *et al.* (E.), 603
- " " effect of, on temperature registration in schizophrenic patients. Buck, C. W., *et al.* (E.), 603
- " " for the relief of intractable pain, unilateral. Scarff, J. E. (E.), 245
- " " self-inflicted. Colom, G. A., and Levine, M. H. (E.), 840
- " " see also under cortical undercutting, lobotomy, topectomy, transorbital leucotomy.
- " lobe and uncus in man, stimulation studies of the. Liberson, W. T., *et al.* (E.), 832
- Prefronto-pontine tract, the origin, course and termination of, in the human brain. Beck, E. (E.), 604
- PRELL, D. B., and EYSENCK, H. J., the inheritance of neuroticism, 443
- Prisol in circulatory deficiency, by L. D. Gardner, 278
- Proteins of the gray and white brain substance, the. Palladin, A. V., and Goryukhina, T. A. (E.), 431
- Psychiatry for Students and Nurses, a Practical Handbook of, by L. Minski (R.), 221
- Psychoanalytic Therapy, Technique of, by S. Lorand (R.), 816
- Psychological testing, an experimental approach to diagnostic, by M. B. Shapiro, 748
- Psychoses in childhood, by M. Creak, 545
- Psycho-social phenomena in small groups, quantitative evaluation of, by F. Kräupl Taylor, 690
- Psychosomatic service, the incidence and significance of hypoglycemia in unselected admissions to a. Landman, H. R., and Sutherland, R. L. (E.), 624
- Psychotics, effect of insulin hypoglycemia on eosinophiles and lymphocytes of. Tsai, S. Y., *et al.* (E.), 627

- Radio-active phosphorus, turnover of, injected into the subarachnoid space of the brain of the rat. Lindberg, O., and Eruster, L. (E.), 433
- Receptors for tonic neck reflexes, location of. McCouch, G. P., *et al.* (E.), 843
- REES, T. P., *et al.*, comments on the opening papers on indications for shock treatment, 132
- REES, W. LINFORD, desoxycortone acetate and ascorbic acid in the treatment of schizophrenia, 376
- „ and JONES, A. M., an evaluation of the Rorschach test as a prognostic aid in the treatment of schizophrenia, etc., 681
- REICH, M., Character Analysis (R.), 815
- Reitman's pin-man test. Reitman, F., and Robertson, J. P. S. (E.), 611
- Respiration movement in normal, neurotic and psychotic subjects. Clausen, J. (E.), 819
- Retinal induction and optical illusion, field of. Motokawa, K. (E.), 418
- RÉVÉSZ, G., Ursprung und Vorgeschichte der Sprache (R.), 218
- RICHARDS, B. W., childhood schizophrenia and mental deficiency, 290
- ROBIN, A. A., a case of aspirin poisoning, 214
- Rorschach study of a group of medical students, a. Molish, H. B., *et al.* (E.), 424
- „ test as a prognostic aid in the treatment of schizophrenia, etc., an evaluation of the, by W. Linford Rees and A. M. Jones, 681
- „ „ the usefulness for diagnosis, prognosis, etc., by D. J. Salfield, 84
- SALFIELD, D. J., the usefulness of the Rorschach test for diagnosis, etc., 84
- SALTER, A., What is Hypnosis? (R.), 597
- SARGANT, W., *et al.*, comments on the opening papers on indications for shock treatment, 132
- Schizophrenia, cephalin-cholesterol flocculation and thymol turbidity tests in. Oltman, J. E., and Friedman, S. (E.), 231
- „ childhood and mental deficiency, by B. W. Richards, 290
- „ constitutional factors in the prognosis of. Kline, N. S., and Tenney, A. M. (E.), 402
- „ desoxycortone acetate and ascorbic acid in the treatment of, by W. Linford Rees, 376
- „ the etiology of. Shulman, A. J. (E.), 248
- „ studies in, by F. N. Bullock, *et al.*, 197
- „ value of convulsive therapy in juvenile. Levy, S., and Southcombe, R. H. (E.), 602
- Schizophrenic subjects, a study of the potassium and sodium content of the blood serum in. Hørup, E. (E.), 399
- SCHNEIDER, K., Klinische Psychopathologie (R.), 816
- Science: Its Method and its Philosophy, by G. B. Brown (R.), 397
- Seizure control, comparative results in, using phenobarbital, dilantin and mesantoin. Ruskin, D. B. (E.), 402
- Seizures, experimental, sensory-induced. Forster, F. M., and Madow, L. (E.), 439
- Sensory displacement, the phenomena of. Binder, M. B. (E.), 827
- Sexual Perversions and Abnormalities, by C. Allen (R.), 221
- SHAPIRO, M. B., an experimental approach to diagnostic psychological testing, 748
- „ „ studies of a perceptual anomaly, 90
- Shock treatment, comments on the opening papers on indications for, by W. Mayer-Gross, *et al.*, 132
- SLATER, E. T. O., evaluation of electric convulsion therapy as compared with conservative methods of treatment in depressive states, 567
- Sleep and metrazol activated electroencephalogram, comparative effectiveness of. Merlis, J. K., *et al.* (E.), 832
- SMITH, R. H. F., permeability of the blood-brain barrier in cases of parenchymatous neurosyphilis, 340
- Speech of Infancy, The, and the Infancy of Speech, by L. Stein (R.), 217
- Spinal afferents to inferior olive in cat, termination of. Brodal, A., *et al.* (E.), 418
- „ cord, effect of acute hypoxia on motor cells of the. Krogh, E. (E.), 621
- „ „ of rabbits in diphtheria, changes of nitrogen metabolism in. Promyslov, M. S. (E.), 625
- „ „ spontaneous electrical activity of the. ten Cate, J. (E.), 607
- „ fluid, surface tension of, and the phenomenon of "antagonism." Piccardi, G., and Ferroni, E. (E.), 620
- Sphingomyelin and the ether-insoluble glycerophosphatide of the brain. Rennkamp, F. (E.), 254
- STEIN, L., The Infancy of Speech and the Speech of Infancy (R.), 217
- STEKEL, W., Autobiography (R.), 220
- STENGEL, E., *et al.*, comments on the opening papers on indications for shock treatment, 132
- Strychnine, an observation on the effect of, on local cortical potentials. Chang, H-T. (E.), 612
- Sympathetic nervous system, the role of vitamin B₁ in the function of the, I. Titaev, A. A. (E.), 434

- Sympathomimetic depressor agents, the Ahlquist, R. P., and Hensen, J. P. (E.), 438
 Szondi test, an account of the, by A. Kaldegg, 555
- Tannic acid and adrenaline and sympathetic nerve activity. Konzett, H. (E.), 440
 TAYLOR, F. KRÄUPL, quantitative evaluation of psycho-social phenomena in small groups, 690
- Temperature regulation in schizophrenia, I and II. Buck, C. W., *et al.* (E.), 601
 Thalamic projection system, organization of the diffuse. Starzl, T. E., and Magoun, H. W. (E.), 842
- THEOBALD, J., *et al.* a central homeostatic mechanism in schizophrenia, 111
 Thiamine, the blocking effect of, on the superior cervical ganglion of the cat. Mazella, H., and Ferrero, N. (E.), 434
 „ the change in the chromophile substance of nerve cells on the addition of, etc. Moiseer, F. A., and Ferkhinin, A. A. (E.), 434
- Thyroid function in mental disease. Bowman, K. M., *et al.* (E.), 415
 TIMOTHY, J. I., *et al.*, cortical dysrhythmia in psychiatry, etc., 174
 Topectomies and lobotomies, prognosis in, relative to body type. Kline, N. S., and Tinney, A. M. (E.), 825
- Topectomy and leucotomy, the surgical uncertainties of, by J. de Beau, 480
 Transorbital leucotomy, some experiences with. Moore, M. T., and Winkelman, N. W. (E.), 822
 „ lobotomy in institutional practice. Jones, C. H., and Shanklin, J. G. (E.), 226
- Tridione, effect of, on the oxygen uptake of mouse brain. Taylor, J. D., *et al.* (E.), 257
 “Tridione,” fifty cases of epilepsy treated with, by J. Hoenig, 362
 Trigeminal neurology and blood-pressure response, etc. Wall, P. D., and Pribram, K. H. (E.), 418
- UCKO, H., Endocrine Diagnosis (R.), 816
 Ursprung und Vorgeschichte der Sprache (Origin and Pre-history of Language), by G. Révész (R.), 218
- Vagotonia, relative. Hornykiewytsch, T. (E.), 432
 Vegetative nervous system and blood-sugar regulation. Simon, K. (E.), 624
 Vestibulo-ocular reflex arc, the elementary. Szentagothai, J. (E.), 418
- VIDOR, M., personality changes following prefrontal leucotomy, etc., 159
 Vomiting center, the. Wang, W. C., and Borison, H. L. (E.), 228
- WADDELL, M., *et al.*, a central homeostatic mechanism in schizophrenia, 111
 Wallerian degeneration, chemical studies on peripheral nerve during, II. Burt, N. S., *et al.* (E.), 860
- WALTER, W. GREY, *et al.*, Electroencephalography (R.), 397
 WAY, L., Adler's Place in Psychology (R.), 597
- WEIR, A. J., and MARTIN, A. W., a comparative study of the drawings made by various clinical groups, 532
 WEIL-MALHERBE, H., and BONE, A. D., activators and inhibitors of hexokinase in human blood, 635
- WHITTERIDGE, D., *et al.*, Electroencephalography (R.), 397
 WILLIAMS, E. G., and FABISCH, W., clinical electrocardiography with an electroencephalograph, 812
- YAP, P.-M., mental diseases peculiar to certain cultures, 313

PART II.—AUTHORS REFERRED TO THE EPITOME.

- | | | |
|----------------------------|--------------------------|------------------------------|
| Abdel-Nabi, S., 857 | Ashby, W., 415, 621 | Belford, J., 439, 601 |
| Abderhalden, R., 255, 256 | Ashby, W. R., 607 | Bender, M. B., 827 |
| Adams, J. E., 856 | Awapara, J., 857 | Bennett, A. E., 415, 627 |
| Ahlquist, R. P., 438 | Aykub, R., 435 | Bentinck, R. C., 856 |
| Albe-Fessard, D., 843 | | Berger, F. M., 629 |
| Albert, H., 839 | Babkin, B. P., 417 | Berther, E. L., 257 |
| Alexander, A. E., 858 | Babskii, E. B., 429 | Bertrand, I., 436, 436 |
| Alexander, L., 401 | Bach, L. M. N., 418 | Bessman, S. P., 431 |
| Altschule, M. D., 404, 405 | Baisset, A., 438 | Binkley, F., 625 |
| Ammon, R., 253 | Baker, A. B., 601 | Blaurock, M. F., 232 |
| Antona, G., 620 | Ballem, C. M., 630 | Blume, 430 |
| Apter, N. S., 822 | Barnes, J. D., 632 | Boncoddo, N. F., 856 |
| Araya, N. T., 430 | Bauer, R., 429 | Bonnycastle, D. D., 439, 601 |
| Arduini, A., 436 | Bayles, S., 224 | Borek, E., 620 |
| Arnstein, L. S., 856 | Beck, E., 604 | Borison, H. L., 228 |
| Artem'ev, V. V., 429 | Beecher, H. K., 631, 852 | Bowman, K. M., 415 |

- Boyarsky, L. L., 857
 Brecher, A., 620
 Brierley, J. B., 242
 Brodal, A., 418, 435
 Brody, H., 256
 Brookhart, J. N., 418, 843
 Brotman, M., 252
 Brown, E. B., jun., 432
 Brust, M., 857
 Buchel, L., 628, 851
 Buck, C. W., 601, 603
 Budanova, A. M., 855
 Burch, L. D., 626
 Burgemeister, B. B., 825
 Burt, N. S., 860
 Busquet, H., 439
 Butler, T. C., 631

 Carlon, C., 631
 Carpenter, M. B., 228
 Carratula, R., 439
 Carscallen, H. B., 603
 Carter, S., 256
 Case, E. M., 858
 Castillo, J. C., 627
 Cataldi, L., 629
 Cavanaugh, D. J., 852
 Caveness, W. F., 619
 Cazort, R. J., 628
 Cazzullo, C. L., 433
 Chang, H-T., 612, 612, 842
 Chauchard, P., 439
 Chittum, J. R., 438
 Chow, K. L., 612
 Christensen, J. H., 849
 Clapp, R. W., 627
 Clark, E. C., 832
 Clausen, J., 819
 Close, W. J., 632
 Cohen, J. A., 255
 Cole, V. V., 437
 Colom, G. A., 840
 Cranswick, E. H., 440

 Dale, P. W., 630
 Davenport, H. A., 859
 Davies, O. L., 433
 De Beer, E. J., 627
 De Jong, R. N., 822
 Derian, P. S., 438
 de Roeth, A., jun., 612
 Desclaux, P., 434
 Didon, P., 619
 Dinerman, A. A., 621
 Dirkin, M. N. J., 843
 Dixon, K. C., 854
 Doust, J. W. Lovett, 846
 Drew, A. L., jun., 228
 Drubin, L., 415
 Duncan, G. M., 249

 Earnest, F., 228
 Ebaugh, F. G., 630
 Eggleston, L. V., 625
 Elliott, K. A. C., 619, 854
 Elsaesser, K. H., 255, 256, 853
 Ernster, L., 433
 Everett, G. M., 257
 Eysenck, M. D., 242
 Eyzaguirre, C., 628

 Faison, E. D., 436
 Farbroth, Ö., 399
 Faribault, C., 253
 Fatt, P., 853
 Fazekas, I. G., 630
 Featherstone, R. M., 252
 Fellenius, V., 432
 Ferkhmin, A. A., 434
 Fernandes, J. F., 855
 Ferrero, N., 434
 Ferroni, E., 620
 Firket, H., 435
 Fless, D. A., 436
 Flexner, L. B., 418
 Flügel, F., 853
 Folkow, B., 621
 Fontan, J. L. R., 620
 Forbes, J. C., 249
 Fornaroli, P., 620
 Forni, P., 255
 Forrer, G. R., 826
 Forster, F. M., 439
 Franck, C., 619
 Frankel, S., 432
 Frankenhaeuser, B., 612
 Freedman, D. A., 621
 Fremont-Smith, K., 852
 French, L. A., 841
 Friedman, S., 224, 231

 Gabraoui, B., 857
 Gamm, S. R., 856
 Gans, M., 839
 Gastaut, H., 409
 Gayet-Hallion, T., 436, 436
 Gellhorn, E., 856
 Gerard, R. W., 857
 Gerebtzoff, M. A., 435
 Gige, W., 857
 Glaser, G. H., 434
 Glees, P., 242
 Gleiss, J., 429
 Goddard, E. D., 858, 858
 Goldbaum, L. R., 436
 Goldner, R. D., 826
 Golstein, M. S., 632
 Goodman, L. S., 629
 Goolker, P., 822
 Gordan, G. S., 856
 Gorman, W. F., 224
 Goto, J., 626
 Goryukhina, T. A., 431
 Grandpierre, R., 619
 Green, J. R., 841
 Greenberg, L. A., 249
 Gregory, R. L., 627
 Grimson, K. S., 438
 Grinker, R. R., 856
 Grinyer, I., 623
 Grezes-Rueff, F., 438
 Grzycki, S., 252
 Guzman Barron, E. S., 854
 Gygax, P. A., 859
 Gzgzzyan, D. M., 622

 Haag, H. B., 852
 Hahn, F., 633, 633
 Hall, T. C., 440
 Halstead, W. C., 606
 Handa, J., 855
 Handa, Y., 855

 Hann, J., 852
 Haour, P., 253
 Harman, P. J., 432
 Harper, E. O., 832
 Harreveld, A. van, 431, 832
 Harris, A. H., 621
 Harris, R. S., 438
 Harrison, R. G., 435
 Hartelius, H., 225
 Harvey, E. A., 438
 Hashimoto, 855
 Hearon, J. Z., 857
 Heil, E., 429
 Hellauer, H. F., 628
 Henderson, N., 619
 Henneman, E., 629
 Henrie, M., 633
 Hensen, J. P., 438
 Herbertson, B. M., 854
 Herken, H., 629
 Herz, E., 228
 Hetenyi, G., jun., 627
 Heusghem, C., 435
 Heyman, A., 626
 Heymans, C., 622, 622
 Hicks, S. P., 435, 860
 Hinsberg, K., 429
 Hoefer, P. F. A., 434
 Holt, W., 822
 Holtz, P., 622
 Hopper, S. H., 437
 Hornykiewytch, T., 432
 Horowitz, E. A., 256
 Howard, I., 438
 Hørup, E., 399
 Hulpieu, H. R., 437
 Hunter, J., 409
 Hurst, E. W., 433

 Ingram, W. R., 832, 838
 Isbell, H., 231
 Issekutz, B., jun., 627, 630, 630

 Jacob, M., 622
 Jarcho, L. W., 628
 Jasper, H., 409
 Jervis, G. A., 620, 620
 Jimenez-Vargas, J., 855
 Jokivartio, E., 630
 Jolley, J. M., 629, 633
 Jones, C. H., 226
 Jones, H. H., jun., 626, 626

 Kalsbeek, F., 255
 Kartasheva, N. V., 435
 Kaytor, F., 611
 Kajtor, F., 629
 Keats, A. S., 631
 Kellgren, J. H., 436
 Kempinsky, W. H., 843
 Kerpel-Fronius, E., 624
 Kershman, J., 832
 Kety, S. S., 440
 Keynes, R. D., 431
 King, R. B., 854
 Kinzius, H., 852
 Kite, W. C., jun., 417
 Kleiss, L. M., 440
 Kline, N. S., 402, 825
 Kobusowna, B., 252

- Kohler, V., 429
 Konecci, E. B., 252
 Konzett, H., 440
 Kornetsky, C. H., 826
 Kral, V. A., 825
 Krebs, H. A., 625
 Kreps, E. M., 435
 Krings, H., 433
 Krogh, E., 621
 Krushinskii, L. V., 436
 Kuffler, S. W., 612
 Kumamoto, T., 855
 Kun, K., 624
 Kuster, F., 433

 Lagreu, R., 257
 Landmann, H. R., 624
 Lange, C., 621
 Laporte, Y., 438
 Leake, T. B., 856
 Leakins, E., 628
 Lecoq, R., 439
 Lehmann, H. E., 825
 Lennox, M. A., 417, 832
 Lester, D., 249
 Leupold, F., 858
 Leusen, I., 256
 Levine, J., 839
 Levine, M. H., 840
 Levine, R., 632
 Levy, S., 602
 Lewis, P. R., 431
 Liberson, W. T., 832
 Libet, B., 857
 Lichtneckert, I., 627
 Lienthal, J. L., jun., 628
 Lindberg, O., 433
 Lindsley, D. B., 607
 Ludwig, B. J., 629
 Livingston, K. E., 619
 Lloyd-Smith, D. L., 409
 Longino, F. H., 438

 Macfarlane, D. W., 628
 MacLeod, L. D., 249
 Madow, L., 439
 Magnitskii, A. N., 253
 Magoun, H. W., 842
 Mandel, L., 622
 Mandel, P., 622
 Margolis, L. H., 603
 Markova, I. A., 437
 Marti, L. A., 854
 Martin, J. P., 829
 Mate, I., 626
 Matzke, H. A., 601
 Mautner, H., 620
 May, L. G., 627
 Mazoué, H., 439
 Mazzella, H., 434
 McCouch, G. P., 843
 McCrum, W. R., 838
 McGowan, A. J., 436
 McIlwain, H., 623, 623, 628, 851, 858
 McLennan, H., 854
 McNabb, A. R., 860
 Meath, J. A., jun., 619
 Merlis, J. K., 832
 Merritt, H. H., 256, 621
 Mescham, I., 602

 Metcalf, B. H., 438
 Middleton, H. H., 255
 Middleton, S., 255
 Miller, J. K., 621
 Milliken, J. R., 842
 Mirsky, I. A., 856
 Miskimon, R. R., 436
 Mohrschulz, W., 437
 Moiseer, E. A., 434
 Molins, M., 855
 Molish, H. B., 424
 Molodkina, L. N., 436
 Mondini, P., 631
 Moore, M. T., 822
 Morton, I. D., 858
 Motokawa, K., 418
 Muller, D., 633
 Munkrad, I., 399
 Muralt, A. von., 252, 622
 Murphy, W. P., 438

 Naess, K., 257
 Nauta, W. J. H., 859
 Nelson, J. T., 628
 Newman, H. W., 630, 849
 Nichols, F. T., jun., 626
 Nielsen, J. M., 606
 Ninane, G., 435
 Noble, R. L., 630

 Ohm, G., 253
 Okinaka, S., 626
 Olson, C. K., 625
 Oltman, J. E., 224, 231
 Ostow, M., 234
 Otila, E., 430

 Palladin, A. V., 431
 Parkhurst, B. H., 404
 Parsons-Smith, G., 407
 Parviainen, S., 860
 Patterson, J. L., jun., 626
 Pavlov, B. V., 628
 Peers, J. H., 435
 Pelikan, E. W., 628
 Penew, L., 429
 Pérez-Tores, H., 620
 Persky, H., 632, 854, 856
 Perutz, M. F., 858
 Petzold, H. V., 849
 Piccardi, G., 620
 Piette, Y., 253
 Pleschmidt, N. W., 852
 Pletsityi, D. F., 859
 Pope, A., 619
 Porter, R. W., 859
 Pribram, K. H., 417, 418
 Promyslov, M. S., 625, 859
 Puschel, 430

 Quinn, K. V., 620
 Quivy, D., 436, 436

 Raab, W., 857
 Ramsey, H. J., 852
 Ravier, H., 853
 Rauch, F., 252
 Reale, G., 857
 Reiner, E. R., 404, 602
 Reiss, E., 624
 Reitman, F., 611

 Rennkamp, F., 254
 Rezek, A., 254
 Richards, R. K., 257
 Roach, J. F., 433
 Roberts, E., 432
 Robertson, J. P. S., 611
 Roizin, L., 838
 Ross, C. A., 854
 Rossiter, R. J., 860
 Rozengart, V. I., 435
 Rudin, D. O., 852
 Rummel, W., 633, 633
 Ruskin, D. B., 402

 Sadove, M. S., 628
 Saito, 855
 Salama, S., 256
 Salt, H. B., 430
 Samuels, A. J., 857
 Sands, S. L., 602
 Sayers, G., 854
 Scarff, J. E., 245
 Scarinci, V., 627
 Schaffarzick, R. W., 439
 Schein, J., 822
 Scheinberg, P., 625
 Scherrer, J., 629
 Schmidt, G., 856
 Scoville, W. B., 821
 Schuster, E. M., 621
 Schwerin, P., 431
 Schwidde, J. T., 252
 Schwobel, G., 252
 Scruggs, J. B., 602
 Semenova, G. T., 621
 Shack, J. A., 436
 Shanklin, J. G., 226
 Shenkin, H. A., 851
 Shimizu, N., 855
 Shulman, A. J., 248
 Silkworth, J. D., 249
 Simon, K., 624
 Slanden, J. L., 842
 Sloan, N., 409
 Snider, R. S., 232
 Soiva, K., 860
 Solma, H., 626
 Soullairac, A., 434
 Southcombe, R. H., 602
 Speranskaya, E. N., 429
 Sperry, W. M., 624
 Spielman, M. A., 632
 Starch, T. J. C., 405
 Starzl, T. E., 842
 Staub, H., 631, 632
 Stead, E. A., 625
 Stern, P., 254
 Straube, G., 430
 Sutherland, R. L., 624
 Swank, R. L., 619
 Sweet, W. H., 243
 Swinyard, E. A., 629, 633
 Szentágothai, J., 418

 Tadokora, 855, 855
 Talbot, S. A., 628
 Taylor, J. D., 257
 Timmes, Y., 860
 ten Cate, J., 607
 Tenney, A. M., 402, 825
 Terner, C., 625

- Teschan, P., 856
 Tetsutaro, 855, 855
 Texon, M., 249
 Thannhauser, S. J., 568
 Thompson, W. C., 418
 Thomson, R. H., 619
 Tinelli, G., 621
 Titaev, A. A., 434
 Todd, A. R., 858
 Toman, J. E. P., 633
 Topper, A., 857
 Torda, C., 257, 632
 Trufant, S. A., 854
 Tsai, S. Y., 627
 Turner, O. A., 234
 Tyler, D. B., 437
 Tyrrell, L. W., 624

 Udenfriend, S., 858
 Umrath, K., 628

 Unna, K. R., 628
 Utter, M. F., 623
 Uvnas, B., 621

 Valerio, V., 629
 Varga, F., 624
 Vigliani, E. C., 433
 Vincent, D., 257
 Vischniac, C., 439
 Vorbrugg, M., 429

 Waelsch, H., 431, 620, 624
 Wall, P. D., 418, 829
 Wang, W. C., 228
 Webster, D. R., 630
 Weinland, W. L., 624
 Weschsler, R. L., 440
 Whielson, J. A., 832
 Wikler, A., 231, 853
 Wilkins, D. S., 252

 William, E. Y., 424
 Williams, D., 407
 Williams, M., 612
 Wilhelmsen, P. C., 854
 Wingo, W. J., 857
 Winkelman, N. W., 822
 Winterstein, H., 435
 Woldring, S., 843
 Wolff, H. G., 257, 632
 Wood, D. R., 436
 Woodbury, W. M., 854
 Wright, S., 256

 Yakovlev, P., 243
 Yoshikawa, M., 626

 Zakusov, V. V., 437
 Zanchetti, A., 436
 Zauder, H. L., 852
 Zimmerman, F. T., 825, 826

VOL. XCVII, NO. 406

JANUARY, 1951

THE JOURNAL OF MENTAL SCIENCE

(THE BRITISH JOURNAL OF PSYCHIATRY)



**BY AUTHORITY OF
THE ROYAL MEDICO-PSYCHOLOGICAL ASSOCIATION**

EDITOR-IN-CHIEF

G. W. T. H. FLEMING

CO-EDITORS

Alexander Walk and P. K. McCowan

AND WITH THE ASSISTANCE OF

E. D. Adrian

E. G. Holmes

Sir F. C. Bartlett

C. J. McCarthy

S. M. Coleman

Alfred Meyer

C. J. C. Earl

Lionel S. Penrose

Sir A. Fleming

A. A. W. Petrie

F. L. Golla

E. T. O. Slater

LONDON

J. & A. CHURCHILL, LTD

Published Four times Yearly Twelve Shillings and Sixpence net

THE JOURNAL OF MENTAL SCIENCE

Communications on general editorial matters, including MSS. for publication, books for review and other printed matter, and communications regarding the *Epitome* section, including journals to be abstracted, should be sent to the **Editor-in-Chief, Barnwood House, Gloucester.**

Communications and inquiries regarding sales should be addressed to the Publishers, **Messrs. J. & A. CHURCHILL, Ltd., 104, Gloucester Place, Portman Square, London, W.1;** and those regarding Advertisements to **Messrs. S. & H. FRETWELL, Ltd., 92, Fleet Street, London, E.C.4.** Phone: Central 5587/8.

THE ROYAL MEDICO-PSYCHOLOGICAL ASSOCIATION.

PUBLICATIONS.

From MESSRS. ADLARD & SON, LTD.,
Bartholomew Press, Dorking, Surrey.

Enquiry (History) Form, for use in Mental Hospitals. In three sizes. Prices and specimen forms on application.

From MESSRS. J. & A. CHURCHILL, LTD.,
104 Gloucester Place, W. 1

"The Journal of Mental Science." Published four times a year. Price 12/6. Postage extra.

From MESSRS. BAILLIÈRE, TINDALL & COX,
8 Henrietta Street, W.C. 2

"Handbook for Mental Nurses." 8th edn. In preparation.

"Manual for Mental Deficiency Nurses." 1931. Price 6/6 net.

"Occupational Therapy." Addendum to "Handbook." 1938. Price 6d.

From the REGISTRAR, Southfield, Shipton Road, York.

"Regulations and Rules for the Nursing Examinations." Revised, 1938. Price 9d. each. Postage 1d.

"Examination Papers, 1928-38." Price 9d. each. Postage 1d.

"Regulations for the D.P.M. of the R.M.P.A."

From the SECRETARY, 11 Chandos Street, W. 1.

The Charter and By-Laws of the Association. Price 2/- Postage 1½d.

Northumberland House Green Lanes, Finsbury Park, N.4

A PRIVATE HOSPITAL for the treatment of Mental and Nervous illnesses. Conveniently situated and easy of access from all parts. Six acres of grounds, facing Finsbury Park. Voluntary and Temporary Patients received without certification. E.C.T., Group Psychotherapy. : Insulin Coma Unit.

Trained Resident and Visiting Staff.

Telephone: Stamford Hill 7866/7 (2 lines.)

Telegrams: "Subsidiary, London."

For further particulars apply to the Medical Superintendent,

ROBERT M. RIGGALL, Member, British Psycho-Analytical Society.



JOURNAL OF MENTAL SCIENCE

CONTENTS FOR JANUARY, 1951

Original Articles—

PAGE

The Presidential Address: The Past and the Future; by <i>K. K. Drury, M.C., B.A., M.D., B.Ch., D.P.M.</i>	1
Frontal Lobe Function and the African; by <i>J. C. Carothers, M.B., D.P.M.</i>	12
Psychological Changes Following Prefrontal Leucotomy; A Review; by <i>Sidney Crown, Ph.D.Lond.</i>	49
The Usefulness of the Rorschach Test for Diagnosis, Prognosis and Epicrisis, Mainly in Child Guidance Treatment; by <i>D. J. Salfeld, M.D., B.Sc.</i>	84
Experimental Studies of a Perceptual Anomaly. I. Initial Experiments; by <i>M. B. Shapiro, M.A.</i>	90
A Central Homeostatic Mechanism in Schizophrenia; by <i>Denis Hill, F.R.C.P., P. St.J. Loe, J. Theobald and Marion Waddell, Ph.D.</i>	111
Comments on the Opening Papers on Indications for Shock Treatment; by <i>W. Mayer-Gross, M.D., William Sargent, F.R.C.P., E. Stengel, M.D., E. C. Dax, B.Sc., M.B., and T. P. Rees</i>	132
Ether: An Estimation of its Use in the Treatment of the Psychoneuroses; by <i>David Gilmour, M.D., D.P.M.</i>	148
Personality Changes Following Prefrontal Leucotomy as Reflected by the Minnesota Multiphasic Personality Inventory and the Results of Psychometric Testing; by <i>Martha Vidor, Ph.D.</i>	159
Further Observations on the Use of Combined Photic and Chemically Induced Cortical Dysrhythmia in Psychiatry; by <i>P. M. O'Flanagan, L.R.C.P.&S.I., D.P.M., J. I. Timothy, M.B., B.S., D.P.M., and H. G. Gibson, E.E.G. Dept.</i>	174
Crime in the Psychoses Complicating Pellagra; by <i>M. K. el Kholy, M.R.C.S.Eng., L.R.C.P., D.P.M.</i>	191
Studies in Schizophrenia; by <i>F. N. Bullock, I. W. Clancey and H. H. Fleischer, M.D.</i>	197
The Treatment of Depression by Dinitrile Succinate; by <i>A. Harris, M.A., M.D., D.P.M.</i>	209
A Case of Aspirin Poisoning; by <i>Ashley A. Robin, M.B., Ch.B.</i>	214

Reviews

217

The Group Approach to Leadership-testing; by *Henry Harris*.—The Infancy of Speech and the Speech of Infancy; by *Leopold Stein*.—Grundlagen der Psychiatrie (Fundamentals of Psychiatry); by *K. Leonhard*.—Ursprung und Vorgeschichte der Sprache (Origin and Pre-history of Language); by *G. Révész*.—Ausdruckssprache der Seele (The Language of the Expressions); by *K. Leonhard*.—Delinquency and Human Nature; by *H. D. Stott*.—Freud or Jung; by *Edward Glover*.—Autobiography; by *W. Stekel*.—Ask the Children; by *Lt.-Col. Ford Thompson*.—The Sexual Perversions and Abnormalities; by *Clifford Allen*.—A Practical Handbook of Psychiatry for Students and Nurses; by *Louis Minski*.

Bibliography and Epitome

223

1. Biochemistry, Pathology, etc.—2. Pharmacology and Treatment.

CONTENTS OF SUPPLEMENT

One Hundred and Ninth Annual Meeting.—South Eastern Division.—Diploma in Psychological Medicine.—Notices by the Hon. Librarian.—Notices by the Registrar.

